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TAI (F. L.). **A species of Choanephora with dichotomously branched conidiophore.**—*Sinensia (Contr. Metrop. Mus. Nat. Hist. Acad. Sinica)*, iv, 8, pp. 215–224, 14 figs., 1934.

In 1933, the author collected at Nanking on decaying pods of *Dolichos lablab* a species of *Choanephora* with dichotomously branched conidiophores. When detached branches of *D. lablab* inoculated with a spore suspension of the fungus were placed in damp chambers the flowers became discoloured and covered abundantly with the typical conidiophores, but the pods, stems, and leaves remained unaffected, the fungus producing rotting only of punctured pods, and being evidently a weak parasite.

As the conidia agree closely with the description of those of *Cunninghamella manshurica* Saito & Naganishi, the author identifies his fungus with the latter which he renames *Choanephora manshurica* (S. & N.) comb. nov. and provides with a full diagnosis in Latin and English.

The morphological characters of the conidia, sporangia and their spores, and zygospores are described and figured, and there is a bibliography of 7 titles.

SINGH (U. B.). **Studies on Cercospora indica n.sp., parasitic on Cajanus indicus Spreng.**—*Indian Journ. Agric. Sci.*, iv, 2, pp. 343–360, 3 pl. (1 col.), 4 graphs, 1934.

This is a detailed account of the author's investigation of a leaf spot of pigeon pea (*Cajanus indicus*), common in Bihar and the United Provinces of India, and caused by two strains of a species of *Cercospora* considered to be new and named *C. indica*. The strains (from Allahabad and Pusa, respectively) are identical morphologically but differ in some of their cultural characteristics.

The first symptom of the disease in nature is the appearance of small, light brown, chiefly interveinal, hypophyllous spots, with dark brown centres, 1 to 2 mm. in diameter but occasionally coalescing to form irregular areas up to 15 by 5 mm. Eventually the affected leaves dry, curl up, and fall off. The fungus also occasionally causes greyish-black, elongated lesions on the petioles and stems. The inter- and intracellular hyphae form loose stromatic masses below the stomata, producing conidiophores which emerge from the latter. A creeping external mycelium is also formed on the surface of the leaves [cf. *R.A.M.*, xii, p. 246]. The conidiophores are mostly hypophyllous, dark brown when mature, simple or branched, often geniculate at the insertion of the conidia, from

28 to 168 by 3·4 to 7 μ, and with from 2 to 13 septa according to moisture conditions. Conidiophores or their pieces readily form hyphae in tap water. The conidia are hyaline to slightly greenish-yellow, multiseptate, abruptly obclavate, sometimes vermiform, very commonly constricted at the septa, from 6·8 to 129 by 3 to 5 μ (average 37 by 4 μ), with from 0 to 9 septa (mode 2). They germinated in tap water in from eight to ten hours at 30° C., but failed to germinate after about two months.

The fungus grew best in culture in alternate light and darkness, less in continuous darkness, and least in continuous light, a feature which it shares with *C. dolichi* [ibid., xi, p. 130]. It tolerated a range of relative humidities from 47 to 100 per cent. with optimum growth at saturation point. No growth occurred at 5·5° or 37·5° C., except on Richards's solution agar at the latter temperature; the optimum for growth was 27·5°. *C. indica* tolerates a wide range of P_H values (from 2·9 to 7·1), with an optimum at 6·7; grown on a modified Richards's solution of varying P_H values it always reduced the latter to 2·9. The size and septation of the spores produced were greatest at temperatures between 20° and 25° C., and sporulation was freest at 20°. No spores were formed at 10° or below. Sclerotium-like bodies were produced in very old cultures, especially on wheat straw and pigeon pea stalks. Intercalary globular chlamydospores were formed at all temperatures; in one of the strains they were dark brown with thick walls, in the other greenish-brown with thin walls.

Both strains were found to be unable to infect pigeon pea leaves when inoculated with mycelium alone, even when placed in nutrient drops. When the leaves were sprayed with a spore suspension, the incubation period lasted ten days on mature and 15 days on young leaves. On six-day-old seedlings raised in artificial culture from sterilized seeds, which were sprayed with a spore suspension, no infection occurred below 20° C. or above 32·5°, the best being at 20° to 25°. Infection took place readily both in darkness and in light. Attempts to inoculate other leguminous species were unsuccessful.

The paper terminates with a comparative table showing the morphological details of *C. indica* [an English diagnosis of which is appended] and of *C. cajani* [ibid., ix, p. 507].

BENNETT (C. W.). **Plant-tissue relations of the Sugar-beet curly-top virus.**—*Journ. Agric. Res.*, xlviii, 8, pp. 665–701, 8 figs., 2 graphs, 1934.

This is a full report of the author's investigation of the distribution of the beet curly top virus [*R.A.M.*, xiii, pp. 285, 558] in the sugar beet and in tobacco plants (*Nicotiana tabacum* and *N. glauca*). It was shown that when the virus was introduced in the water-conducting vessels of the sugar beet, it did not pass from the tracheae into cells or tissues where it could become established and produce pathological symptoms. A study of the feeding habits of the vector of the virus (*Eutettix tenella*) [loc. cit.] and the cytological examination of its punctures in the host tissues indicated that the leafhopper chiefly feeds on the leaf veins and that its mouth parts usually penetrate the phloem region, the gelatinous sheath left by it in the tissues probably sealing off all

the cells that are penetrated by the stylets outside the phloem, and thus protecting the virus from contact with the cell contents in these tissues. The exudate occurring naturally on the petioles and leaf blades of curly top beets, as well as that exuding from the cut surface of affected beetroots, was shown to have a high virus content as compared with the juice extracted from tissues containing no vascular elements, the evidence indicating that both exudates are derived largely from the phloem. When healthy beets were grafted with diseased plants no infection took place unless full union of the grafts occurred. In similarly grafted tobacco plants the earliest infections occurred on the seventh day, when the tracheal elements formed in the unions were apparently mature, the percentage of infection increasing from 27 on that day to 100 on the twelfth. Finally, in ringing experiments with *N. tabacum* and *N. glauca*, the virus passed all rings bridged by an uninterrupted path of phloem, whether internal or external, or both combined. Interruption of phloem continuity in the stems prevented the passage of the virus through the rings, except in a few cases, in which areas were found of regenerated tissue connecting the internal and external phloem through the woody cylinder.

All these results, coupled with the failure to obtain infection of the beets by introducing the virus into the parenchyma cells and the rapid inactivation of the virus in expressed juice, as well as the failure of the leafhoppers to acquire the virus from any type of parenchyma except that immediately below the crown, would indicate that the curly top virus is largely restricted to the phloem of the hosts, probably even more closely so in the two species of infected tobacco investigated than in the beet. Attempts to obtain the virus by the leafhoppers from very young beet seed gave negative results.

In a further series of experiments it was shown that the movement of the curly top virus in tobacco is relatively slow as compared with that in the sugar beet, in which at temperatures from 85° to 135° F. the virus moved downward in young seedlings a distance of 1 in. in two minutes and in larger plants a distance of 6 in. in six minutes; in tobacco the fastest movement observed was downward from the point of inoculation to a distance of 24 in. in 48 hours. The rapid movements of the virus in the beet are considered to occur evidently in the phloem, and it is suggested that they indicate a rapid translocation of plant food materials.

De Haan (K.). **Beschouwingen over de praktische Suikerbietenteelt. IV. Mangaan-gebrek bij Suikerbieten.** [Observations on practical Sugar Beet cultivation. IV. Manganese deficiency in Sugar Beets.]—*Meded. Inst. Suikerbietenteelt*, 5, pp. 123–127, 1934.

Since 1931 studies have been in progress on the manganese deficiency of beets [cf. *R.A.M.*, viii, p. 751; xii, p. 19; xiii, p. 10] in the Kreekerak and Völckerpolder districts of Holland. The young leaves of affected plants show a pallor of the interveinal areas on which minute white (later brown), depressed spots develop and ultimately collapse, leaving cavities of variable size. The

margins turn upwards and the tips are abnormally pointed. Newly formed leaves are healthy at first but rapidly acquire the symptoms of nutritional deficiency. In an experiment in 1933 the beet yield was increased from 53,300 to 55,400 and 56,000 kg. per acre, respectively, by spraying the plants twice (on 13th June and 17th July) with 15 kg. per hect. of a 1·9 per cent. solution of manganese sulphate and by one application to the soil (13th June) of manganese sulphate mixed with sand at the rate of 60 kg. per hect. The corresponding figures for the sugar yield were 7,660, 8,060, and 8,070 kg. per hect. There is little to choose between spraying and strewing the manganese sulphate, the former method being more economical and rapid in its action, while the latter is simpler of application and equally efficient.

In 1932 and 1933 the reclamation disease of oats [ibid., xiii, p. 324] was also completely prevented by manganese sulphate (60 kg. per hect.).

WHITE (H. L.). **The sterilization of Lettuce seeds.**—*Nineteenth Ann. Rept. Cheshunt Exper. & Res. Stat., Hertfordshire, 1933,* pp. 47–51, 1934.

When Golden Ball lettuce seed treated with formalin at different concentrations for various periods of time was germinated in Petri dishes no treatment that allowed germination gave efficient disinfection. As the minimum bactericidal dose is 2 per cent. for two hours, which is twelve times that which just failed to injure the lettuce seed, it is concluded that formalin treatment is unsuitable for lettuce seed disinfection. When copper sulphate solution was used, the only treatments which reduced the number of contaminated seeds to 10 per cent. of those in the controls were 2 per cent. for 1 hour, 1 per cent. for 4·5 hours, and 2 per cent. for 4·5 hours. The last appreciably reduced germination, but the other two treatments are to be submitted to further test. Although it may be possible to use copper sulphate as a seed treatment with some varieties of lettuce, the margin of safety between the minimum bactericidal dose and the maximum dose tolerated by the seed is so small that the treatment cannot be regarded as satisfactory. Other tests demonstrated that copper sulphate and uspulun at strengths which severely retarded the germination of Golden Ball were harmless to Gotte à Forcer seed; resistance to seed injury in lettuce is evidently a varietal characteristic.

Market pathology notes from Chicago.—*Plant Disease Reporter,* xviii, 4, p. 40, 1934. [Mimeographed.]

Carrots grown in New York and placed immediately after digging into cold storage showed small, depressed areas on the roots bearing the hyphae of a *Corticium*; definite clamp-connexions were noted, and the mycelium on many of the spots bore basidiospores. Favoured by storage conditions infection had taken place through the secondary roots and spread into the tap-root. *Rhizoctonia* crown rot [? *C. solani*: *R.A.M.*, v, p. 644] was also present, and sclerotia were found on a few roots, but the *Corticium* decay was much the more important trouble.

Gassner (G.) & Hassebrauk (K.). **Über Spargelrost und seine Bekämpfung.** [On Asparagus rust and its control.]—*Deutsche Landw. Presse*, lxi, 18, pp. 215–216, 1 fig., 1 diag., 1934.

In this paper (which summarizes an expanded version simultaneously published in *Gartenbauwissenschaft*, viii, pp. 455–476, 1934) the writers give a semi-popular account of the life-history, symptoms, and control of asparagus rust [*Puccinia asparagi*] in Germany [*R.A.M.*, xii, p. 745], where the loss in a single year from this disease may amount to between 10 and 11 million marks. Direct measures of control gave unsatisfactory results in the writers' experiments, and the occasional favourable reports on the effects of copper-containing preparations are believed to rest on faulty observation. There is little prospect, moreover, judging by the outcome of recent investigations by the German Horticultural Association, of developing rust-resistant varieties on a commercial scale; the Washington types, resistant in the United States [ibid., x, p. 288], have proved susceptible in Germany.

In the north German asparagus plantings pycnospores are formed in profusion towards the end of May, followed during the first half of June by aecidiospores, from which the familiar brown summer (uredo) stage arises, followed by teleutosori. It is apparent that the suppression of the last-named (the sole means of overwintering of the fungus) will automatically prevent the development of the epidemic summer phases. This necessitates the destruction of the tops, special attention to which should be paid in the vicinity of young plantings. The writers are of opinion that the existing legislation against *P. asparagi* [ibid., xii, p. 336] should be revised so as to enforce the removal of the tops as early as October in all cases where they are likely to act as sources of infection in the spring. It would further be advisable to restrict the establishment of young plantings, which are essential to the initiation of epidemics, to three- or five-yearly intervals and to place all such new stands under official supervision.

Nicolas (G.). **Sur un Alternaria parasite du Melon.** [On an *Alternaria* parasitic on Melon.]—*Rev. Path. Vég. et Ent. Agric.*, xxi, 1, pp. 15–17, 1934.

The author states that in 1932 Cantaloupe melons originating from Vaucluse [south France] were found on the Toulouse market to be affected with a rot caused by *Alternaria brassicae* var. *nigrescens* [*A. cucumerina*: *R.A.M.*, xi, p. 696], which rendered them unfit for human consumption. The fruit showed a number of depressed, confluent spots, several cm. in diameter, bearing fructifications of the fungus, the [ob]clavate conidia of which measured 100 to 130 by 20 to 26 μ.

Lebedeva (Mme L. A.). Заготовка дикорастущих съедобных грибов. [The preservation of wild edible fungi.]—116 pp., 33 col. pl., 19 figs., Плодоовощное Объедин. Ленинградского Союза Потреб. Об-в-, Научно-Консульт Бюро [Scient. Consult. Bur., Greengrocery Assoc. of Leningrad Union of Consumers' Soc.], Leningrad, 1933. [Received August, 1934].

The purpose of this small book is stated to be to draw attention

to the high nutritive value of edible fungi, and to popularize their general use as a means of compensating for the acute shortage of animal food which is now felt in U.S.S.R. It gives popular descriptions of 28 of the more common and palatable species in Russia, which are illustrated by well-executed original coloured plates. A few of the poisonous toadstools are also included, so that they may be recognized and avoided. In a separate section detailed instructions are given for the collection and industrial preservation of the fungi by several different methods.

MENDOZA (J. M.) & LEUS-PALO (SIMEONA). **Lepiota americana, an immigrant edible Mushroom.**—*Philipp. Journ. of Sci.*, liii, 3, pp. 223–225, 227, 2 pl., 1934.

A technical description is given of *Lepiota americana* Peck, a mushroom possibly introduced into the Philippines on animal fodder, the edibility of which was demonstrated at the Bureau of Science, Manila. It is collected and sold in small quantities on the market.

MÜLLER (K.) & SLEUMER (H.). **Biologische Untersuchungen über die Peronosporakrankheit des Weinstockes mit besonderer Berücksichtigung ihrer Bekämpfung nach der Inkubationskalendermethode.** [Biological investigations on the *Peronospora* disease of the Vine with special reference to its control by the incubation calendar method.]—*Landw. Jahrb.*, lxxix, 4, pp. 509–576, 10 figs., 2 graphs, 1 map, 1934.

A comprehensive account, based on twenty years' practical experience of the senior writer and a survey of the relevant literature, is given of the history, biology, symptoms, economic importance, and control of the downy mildew of the vine caused by *Plasmopara viticola*.

In Central Europe the incubation period of the disease ranges from 5 to 18 days according to the weather conditions. The minimum temperature for the occurrence of an outbreak of practical significance is 12° to 13°, optimum 18° to 24°, and maximum about 30° C. A prerequisite condition for an attack is a film of moisture on the leaves, and it is stated that this may be produced by an atmospheric humidity of 70 to 85 per cent. on young, and by 80 to 100 per cent. on older foliage. Heavy falls of rain are necessary to cause primary infection [*R.A.M.*, xii, p. 198], but secondary infections may follow showers or result from the presence of mist and dew, provided the leaves remain moist for several hours round about midnight and the temperature is above 12° to 13° [ibid., x, p. 432].

The toxicity of copper-containing fungicides to *P. viticola* is discussed on the basis of recent chemical researches [ibid., xiii, p. 423 *et passim*]. Some general cultural measures calculated to reduce the incidence of downy mildew are indicated and a full description is given of the methods locally employed for forecasting outbreaks of the disease and directing spraying operations on a phenological basis. By means of the so-called 'incubation calendar' immense losses are stated to have been averted and the average two-year-yield of the Baden vineyards doubled.

A bibliography of 126 titles is appended.

L. (M.). **Actualités. Mildiou.** [Current notes. Mildew.]—*Rev. de Vitic.*, lxxx, 2086, p. 398, 1934.

Between the 10th and 20th June, 1934, vines in the south of France were severely attacked by mildew [*Plasmopara viticola*] both on the leaves and fruit clusters. Non-setting of the fruit [*R.A.M.*, x, p. 640] was conspicuous on very vigorous vines, with the result that the crop will be seriously reduced, at least in the south of France, where in the department of Var the white Uqui vines have already lost half their berries. Serious outbreaks were also reported from two localities in Algeria on the 15th June, much of the fruit being destroyed by the grey rot form of attack [ibid., xii, p. 72].

Dubaquié (J.). **Sur la dispersion des éléments actifs dans la lutte contre les cryptogames.** [On the dispersion of the active elements in the chemical control of fungi.]—*Rev. de Vitic.*, lxxx, 2086, pp. 389–397, 1934.

After lucidly discussing the various theories advanced to explain the toxic action of copper mixtures on vine mildew [*Plasmopara viticola*], the author points out that all agree in insisting on the maximum possible dispersion of the copper on the susceptible parts of the plant and on the necessity for good adhesive properties. It is not necessary to cover the parts sprayed with a continuous layer of insoluble metal particles, neither need the spots of spray contain a very high percentage of copper. The spreader used should reduce the volume of the drops to a minimum and ensure their perfect adherence to the vine. The essential factor is dispersion. He discusses particularly the advantage of dusts in which sulphate of copper is very slowly dissolved or liberated from the mixture. In these the copper content can be very low, provided it is dispersed in a form either soluble in atmospheric moisture or capable of going into fine suspension in rain or dew deposits. It is the copper itself and not any of its basic sulphates that is the important ingredient, and attention should be concentrated on improving the means of applying it so as to favour the maximum dispersion and adherence of copper on the parts exposed to attack.

Ravaz (L.). **Chronique. Les additions aux bouillies. L'excoriose.** [Current events. Additions to mixtures. Excoriosis.]—*Prog. Agric. et Vitic.*, ci, 16, pp. 367–370, 1934.

In the first of these two brief notes the author discusses the various forms in which sulphur is added to cupric mixtures used in the simultaneous control of *Oidium* [*Uncinula necator*] and mildew [*Plasmopara viticola*] of the vine, and the best methods to ensure its incorporation in the mixtures.

In the second note some observations are reported which appear to confirm the author's previous opinion that vine excoriosis [*Phoma flaccida*: *R.A.M.*, xii, p. 420] chiefly attacks the lowermost buds on the current year's branches, and that tall training of affected vinestocks affords an effective method for the control of the disease.

There also was some evidence that excoriosis is not readily transmissible by the spores of the fungus, but that once it has entered the host tissues it is capable of remaining indefinitely in stocks trained low.

VIALA (P.) & MARSAIS (P.). **Sur la biologie du Pumilus medullae, cause du court-noué parasitaire de la Vigne.** [On the biology of *Pumilus medullae*, the agent of parasitic court-noué of the Vine.]—*Comptes rendus Acad. des Sciences*, cxcviii, 18, pp. 1557–1560, 1934.

Further studies on the causal organism of parasitic court-noué of the vine (*Pumilus medullae*) [*R.A.M.*, xiii, p. 562] have led to the conclusion that the thick-walled, unicellular, hyaline, navicular spores, narrowed at the ends and measuring 10 by 2 μ, should be regarded as spermatia. The spermogonia, without ostioles, have been found in large numbers on dying or dead vine stems in nature, occurring in longitudinal rows, sometimes closely serried, following the direction of the medullary rays. They are embedded in the phloem which is destroyed and replaced by shapeless stromatic masses.

A similar external appearance is presented by the parallel rows of pycnidia and perithecia, which are, however, rather larger and more undulate than the spermogonia. The subcylindrical, obtuse ended, unicellular, thick-walled pycnospores measured 15 by 10 μ. Brown, uniseptate conidia develop on short conidiophores arising from a blackish pseudoparenchyma on the pycnidial surface, and measure 20 by 12 μ. The inner walls of the subovoid perithecia bear numerous asci, 55 by 6 μ, occupied by unicellular, ovoid to reniform, hyaline ascospores, measuring 11 by 4 μ. The thick membrane of all these organs consists of several superimposed layers of polyhedric cells and is very hygroscopic, so that the spores are exuded through fissures in the walls in immense numbers on immersion in water. All the spores—spermatia, pycnospores, and ascospores—germinate readily and reproduce the characteristic mycelium of *P. medullae*.

This new genus of Ascomycetes belongs to the family of Sphaeriaceae near *Xylaria* and *Eutypa*. [This paper also appears in *Comptes rendus Acad. d'Agric. de France*, xx, 15, pp. 515–519, 1934 and *Rev. de Vitic.*, lxxx, 2079, pp. 277–279, 1934.]

Fungus and other diseases of crops 1928–1932.—*Min. of Agric. & Fish. Bull.* 79, 117 pp., 8 pl., 1 map, 1934.

The information contained in this bulletin (compiled jointly by G. H. Pethybridge, W. C. Moore, and A. Smith) is stated to be based mainly on the monthly reports on the incidence and severity of crop diseases received at the Ministry's Plant Pathological Laboratory from the advisers in mycology in the 14 administrative provinces (reduced to 13 in October, 1932) of England and Wales [cf. *R.A.M.*, ix, p. 287].

Among the new records of special interest the following may be mentioned. *Bacterium marginatum* was isolated from imported gladiolus corms [ibid., xii, p. 356] in 1929, the scab or neck rot for which it is responsible being subsequently observed in the field in

Surrey, Sussex, and Norfolk. In 1930 *Oidium hortensiae* [*Microsphaera polonica*: ibid., xiii, p. 655] developed on hydrangeas in Warwickshire. Glasshouse potatoes at Cambridge were severely attacked in 1932 by the oidial stage of a powdery mildew, possibly *Erysiphe cichoracearum* [cf. ibid., vi, pp. 59, 714; vii, p. 534; xi, p. 226]. *Kunkelia nitens*, detected in 1931 on three Lucretia dewberry [*Rubus flagellaris*] plants [ibid., xi, p. 423], was successfully eradicated by burning the diseased individuals and their immediate neighbours. Slight infection of beet leaves by *Ascochyta betae* [ibid., x, p. 425] was observed in Devon in 1928. *Fusarium tubercularioides* caused leaf spotting of tulips in Devon in 1931–2 and in the latter year also in Cornwall. Carnations in Middlesex were affected in 1932 by a basal leaf and stem rot associated with the presence of *Colletotrichum herbarum*. Lily (*Lilium umbellatum*) foliage in Sussex developed a brown spotting due to *Kabatiella microsticta* in 1930 [ibid., x, p. 583]. *Sclerotium delphinii* [ibid., xiii, p. 99] was responsible for heavy losses among bulbs of the last-named host imported from Japan in 1929, and caused slight damage to English iris bulbs in Buckinghamshire in 1932.

WORMALD (H.). **Notes on plant diseases in 1933.**—*Ann. Rept. East Malling Res. Stat. 1st Jan. 1933 to 31st Dec. 1933*, pp. 142–146, 1934.

This account of plant diseases investigated at the East Malling Research Station, Kent, in 1933 [*R.A.M.*, xii, p. 487] contains, among others, the following items of phytopathological interest.

A Morello cherry twig bore a young shoot girdled by a lesion in the middle of which was a node with a withered leaf showing the fructifications of *Botrytis cinerea* [ibid., viii, p. 153], the evidence indicating that the fungus had extended into the shoot after infecting the leaf.

Very severely blistered apple twigs and stems were received from Sussex and Essex, respectively, but though the condition is constantly associated with *Coniothecium chomatosporum* [ibid., xi, p. 51], experiments have hitherto failed to establish the parasitism of this fungus.

In one instance, raspberry canes were found to bear fruits the majority of which were worthless owing to attack by *Sphaerotheca humuli* [ibid., xii, p. 678]. Loganberry fruits also showed a similar spotting, the same fungus being present on the spots.

POLLACCI (G.). **Rassegna sull' attività del Laboratorio Crittagamico di Pavia (Osservatorio Fitopatologico per le provincie di Cremona, Parma, Pavia e Piacenza) durante l'anno 1933.** [Report on the activity of the Cryptogamic Laboratory of Pavia (Phytopathological Observatory for the provinces of Cremona, Parma, Pavia, and Piacenza) during the year 1933.] —*Atti Ist. Bot. R. Univ. di Pavia*, Ser. IV, v, pp. 3–23, 1934.

In this report, which is on the same lines as those for previous years [cf. *R.A.M.*, xiii, p. 150], a summary is given of the work carried out in 1933 at the Cryptogamic Laboratory, Pavia, followed by a list (arranged under hosts and including a very large number of human and animal pathogens) of the diseases identified during

the year. Much of the information given has already been noticed from other sources [cf. ibid., xiii, pp. 209, 268, 384, 511, 547].

EASTHAM (J. W.). **Report of Provincial Plant Pathologist.**—*Twenty-eighth Ann. Rept. Dept. of Agric. British Columbia for the year 1933*, pp. Y 32–Y 38, 1934.

Details are given of further comparative experiments with different fungicides against apple scab [*Venturia inaequalis*] in the West Kootenay district of British Columbia [*R.A.M.*, xii, p. 678], from which it appears that adequate control is given in normal seasons on all but the most susceptible varieties by properly timed applications of lime-sulphur 1 in 80 or a mixture of lime-sulphur (½ gall.) and calcium monosulphide (3½ lb.) in 40 galls. water. A considerably more effective but also more expensive mixture consists of 10 lb. ferrous sulphate powder, 2½ galls. lime-sulphur, and 5 lb. calcium arsenate (4 lb. for calyx and later applications).

A hitherto unidentified fungus was isolated from the small, brown, firm, rotted areas round the calyx end of Cox's Orange and Rome Beauty apples in the Queens Bay district, where losses up to 5 per cent. from this source have been recorded.

During 1932–3 the following wheat varieties proved immune from bunt [*Tilletia caries*: ibid., xiii, p. 86] in artificial inoculation tests at the Saanichton Experimental Station: Albit, Ridit, Oro, Jen. × Ridit, White Odessa, Martin, and Hussar. Resistance was shown by Dawson's Golden Chaff, Sun, Golden Sun, Berkeley Rock, Kharkov, Minhardi, and Yeoman, whereas Imperial Amber, A.O.C. 104, and Crail Fife were moderately susceptible and Hybrid 128 highly so.

NARASIMHAN (M. J.). **Report of work done in the Mycological Section during 1932–33.**—*Admin. Rept. Agric. Dept. Mysore for the year 1932–33*, pp. 53–56, 1934.

During the year ending 30th June, 1933, materials sufficient to spray about 9,450 acres of areca palm [*Areca catechu*] against koleroga [*Phytophthora arecae*: *R.A.M.*, xiii, p. 77] were supplied to growers in Mysore, the total transactions amounting to Rs. 24,142 [about £1,800].

Of 11 areca palms inoculated with the 'anaberoga' organism 5 became infected, 2 others showed root discoloration, and 2 developed yellowing of the crowns. In another experiment five months after tying the inoculum to two roots from which an outer piece had been removed, one was dry, friable, discoloured, and contained the fungus in the tissues, while the end of the other still attached to the tree had rotted.

The fungus causing coco-nut anaberoga [*Ganoderma lucidum*: ibid., xii, p. 76] formed sporophores in culture.

Good results in the control of mildew [? *Oidium* sp.: ibid., ix, p. 765] of betel [*Piper betle*] were obtained by spraying with Bordeaux mixture (½ per cent.) with casein, 1 per cent. oolite sulphur, emulsions of hongé [*Pongamia glabra*] or castor soap and 0·5 per cent. gingelly [*Sesamum indicum*], groundnut, or *P. glabra*

oil, and ½ per cent. Bordeaux mixture with 1 per cent. of the same oils [cf. ibid., xiii, p. 573].

Spraying against *Alternaria* disease of potatoes [*A. solani*: ibid., xiii, p. 78] has proved to be less popular than was anticipated. Plots sprayed with ½ per cent. Bordeaux mixture when the crop was about 30 days old and again a month later gave an increased yield of 20 lb. per gunta over the unsprayed control plots. Spraying with calcium arsenate (1 lb. in 50 galls. water) checked infection.

The flowers of the susceptible varieties H2, H22, H40, and Local Hullubele of ragi [*Eleusine coracana*] in pots were artificially inoculated with smut [*Ustilago eleusinis*: ibid., xi, p. 158] on three consecutive days in November, 1932; seeds from each were sown in pots in January, 1933, but no smut resulted.

Other records include *Pythium de Baryanum* on chilli fruits [*Capsicum annuum*], *Entomophthora aphidis* [ibid., viii, p. 779] on aphids infesting vegetables, *Rhizoctonia* sp. on soy-bean, and species of *Fusarium* on cotton and plantains [*Musa paradisiaca*].

PLYMEN (F. J.). **Reports on the working of the Department of Agriculture of the Central Provinces for the years ending the 31st March 1932 and the 31st March 1933.**—40 pp., 1933. [Received September, 1934.]

The following references of phytopathological interest occur in this report. The seedling blight of cotton caused by *Rhizoctonia bataticola* [*Macrophomina phaseoli*: *R.A.M.*, xi, pp. 104, 221, and below, p. 697] was found in 1931–2 to be more severe in late than in normally germinating seedlings, and also in fields where the crop was sown early in dry soil. Anthracnose [*Colletotrichum indicum*: ibid., xiii, p. 508] caused heavy damage on early bolls and on the lint and seed of the first picking. *Gossypium* [*neglectum*] *verum* 262 proved more susceptible both to seedling blight and anthracnose than *G.* [*n.*] *roseum*, and in 1932–3 the latter outyielded the former on the Akola farm by 23 per cent. on account of its superior resistance to these diseases.

The linseed selection E.B. 3 combines desirable constitutional characters with resistance to rust [*Melampsora lini*], an important factor locally in reducing the yield of this crop. Satisfactory results have been given by crosses between E.B. 3, and the local and Punjab linseeds and Irish flax, both in respect of yield and rust resistance.

In a series of inoculation experiments on 72 cultures of pigeon pea (*Cajanus indicus*) at Nagpur in 1931–2 with the wilt organism [*Fusarium vasinfectum*: ibid., xiii, p. 345], the incidence of infection ranged from 3 to 94 per cent. Attention is now being concentrated on the development of resistant strains, i.e. those showing not more than 25 per cent. infection. Strain No. 3 having already given satisfactory results, arrangements were made for its multiplication and distribution.

The highest yield of gram (*Cicer arietinum*) was obtained in 1931–2 from a hybrid between the wilt [? *Fusarium*: ibid., ix, p. 10] resistant Cawnpore type and the best local selection No. 28.

In 1932–3 the Cawnpore and Karachi types maintained their wilt-resistant qualities.

Copper carbonate has been found considerably more effective, but also more expensive, than sulphur in the control of sorghum smut [*Sphacelotheca sorghi*: ibid., xi, p. 103].

[Mitra (S. K.).] **Appendix IV. Mycology.**—*Ann. Rept. Dept. of Agric., Assam, for the year 1931–2*, pp. 51–52, 1933. [Received September, 1934.]

Notes are given on the incidence and control of a number of well-known diseases of economic crops in Assam, India, during 1931–2.

Report on the Agricultural Department, Dominica, for the year ended 31st December, 1933.—*Trinidad, Imper. Comm. of Agric. West Indies*, 25 pp., 1934.

The following references of phytopathological interest occur on pp. 5, 6, and 10 of this report. Efforts to obtain a lime combining resistance to wither-tip [*Gloeosporium limetticolum*] with the superior qualities of the West Indian lime have been continued [*R.A.M.*, xii, p. 22]. It is estimated that some 1,500 acres have been planted with limes budded on disease- and hurricane-resisting stocks.

An examination at the Imperial College of Tropical Agriculture of diseased 'cocoye' (*Musa* sp.) plants from a northern estate indicated that *Bacterium solanacearum*, the agent of 'moko' disease [ibid., x, p. 472 and below, p. 713] was responsible. Susceptible banana varieties include Dwarf or Cavendish, Red, Giant Fig, and Moko (Bluggoe of Grenada).

Fifty-second Annual Report of the Ohio Agricultural Experiment Station 1932–1933.—*Ohio Agric. Exper. Stat. Bull.* 532, 112 pp., 7 figs., 3 diags., 5 graphs, 1 map, 1934.

In the section of this report [cf. *R.A.M.*, xii, p. 356] on botany and plant pathology (pp. 33–38), Young states that the spring of 1933 was the first season when the spray service considered it useful to recommend the application of three pre-blossom sprays for the control of apple scab [*Venturia inaequalis*], owing to the prolonged period of spore discharge by the fungus induced by frequent rainy periods. He also briefly mentions tests of several copper compounds for the purpose of finding a safe substitute for Bordeaux mixture which frequently causes considerable spray injury in Ohio, particularly to the fruit, at practically all strengths; one form of basic copper chloride gave good control of scab, and caused much less injury than the regular copper sprays or dusts; it is considered to be sufficiently promising to warrant further trials.

With reference to the continued campaign against raspberry diseases [loc. cit.], Young and Winter state that the results so far obtained indicate that practically disease-free plantations can be maintained by careful inspection and roguing from year to year. This is well illustrated by the fact that the average of 20 black raspberry [*Rubus occidentalis*] plantings from 2 to 8 years old,

belonging to growers who have co-operated in the scheme, gave less than 0·25 per cent. total virus diseases and less than 0·1 per cent. crown gall [*Bacterium tumefaciens*], as compared with anything from 5 to 100 per cent. total disease found in ordinary plantings in the State.

According to Wilson, continued varietal tests of celery for resistance to celery yellows [*Fusarium* sp.: loc. cit.] showed Columbia (which belongs to a group of resistant varieties) to have been the most resistant of the varieties tried in 1933. Early Fortune, Golden Plume, Newark Market, and Wonderful gave 20, 28, 29, and 29 per cent. disease, while Golden Phenomenal, Hoover's Special, and Golden Self Blanching were 75, 76, and 83 per cent. diseased, respectively.

Alexander states that a source of resistance to tomato leaf mould [*Cladosporium fulvum*: ibid., xii, p. 250] was offered by an off-type tomato plant which was found in a greenhouse in the spring of 1930; it was crossed with the varieties Marhio and Globe, and 23 F_5 selections of these crosses are pure lines for complete resistance to the disease but produce fruit which is too small and lacking in quality for commercial usage; good increase in size of fruit has, however, been obtained by crossing the original hybrids with commercial varieties.

In a brief report on maize seed-grain treatment for the control of Stewart's wilt disease (*Phytomonas* [*Aplanobacter*] *stewarti*) [ibid., xiii, p. 298], Thomas states that in greenhouse tests hot water treatment at 52° C. for 10 minutes reduced the percentage of disease to 5·3, as against 30·6 in the controls, while steeping pre-soaked grain in 1 in 180 formaldehyde for three hours gave complete control of the disease.

May reports that as a result of an extensive investigation of the pine canker found some two years ago in Ohio, the cause of the disease has been tentatively identified as *Atropellis pinicola*, a fungus which was described as a minor parasite of western white pine [*Pinus monticola*] in the Pacific Northwest [ibid., ix, p. 815]. This fungus has now been collected on eastern white pine [*P. strobus*], and it may serve as an example of an organism native to, and of little importance in, one area of the country, assuming considerably greater importance when introduced into another region.

FAWCETT (G. L.). **Departamento de Botánica y Patología Vegetal.** [Department of Botany and Plant Pathology.]—*ex* **Memoria Anual del Año 1932** [Annual Report for the year 1932.]—*Rev. Indust. y Agric. de Tucumán*, xxiii, 11–12, pp. 243–247, 1933. [Received September, 1934.]

The white, transverse stripes, similar to those induced by cold, previously observed on sugar-cane leaves in Tucumán, Argentine Republic [*R.A.M.*, xii, p. 786], were found to develop as a result of exposure of the buds to a temperature range of 35° to 49° C. for periods of 1 to 4½ hours. The effects of exposure to heat thus simulate those attributed to low temperature; they are purely transitory, the bleached portions being rapidly shed.

Some of the new local cane varieties developed another type of spotting of obscure origin, consisting of small, reddish, circular

lesions completely covering the leaves and causing premature desiccation. Inoculation experiments with the juice of diseased foliage on P.O.J. 36 and 213 gave negative results.

It was established by cross-inoculation experiments that the 'corcova' ['hunchback'] disease of tobacco [ibid., xi, p. 269] is identical with a disease commonly affecting tomatoes in the spring. Tobacco inoculated from diseased tomatoes developed characteristic symptoms of corcova and vice versa. This disorder is stated to be a limiting factor in tobacco cultivation under local conditions.

Citrus leaves from Paraguay were found to bear lesions resembling those of canker [*Pseudomonas citri*], but on examination at the United States Department of Agriculture the disease was stated to be not canker but one which the Department had not previously seen and which appeared to be unknown elsewhere [cf. ibid., xiii, p. 437].

LEEFMANS (S.). **Ziekten en plagen der cultuurgewassen in Nederlandsch Oost-Indië in 1931.** [Diseases and pests of cultivated crops in the Dutch East Indies in 1931.]—*Meded. Inst. voor Plantenziekten*, 82, 92 pp., 1934.

The following are among the numerous interesting items contained in this report, prepared on the usual lines [*R.A.M.*, xii, p. 425]. Red root rot (*Ganoderma*) [*pseudoferreum*] has been definitely ascertained to occur on *Cinchona* in Central Java [ibid., ix, p. 161].

Coryneum myristicae was again responsible for serious financial losses in the nutmeg crop in Central Java, up to 50 per cent. of the fruits bursting before ripening, of which only a portion can be marketed as low-grade produce. A species of *Phytophthora* [ibid., xii, p. 425] attacked the stems of nutmeg trees but was adequately controlled in most cases by excision of the diseased tissues and painting with carbolineum.

Yellow spot [*Cercospora kopkei*: ibid., xi, p. 205] was the most important disease of sugar-cane in East Java [ibid., xiii, p. 654], where the susceptible P.O.J. 2878 variety is extensively cultivated. Leaf scald [*Bacterium albilineans*: loc. cit.] occurred sporadically in young stands, chiefly in Central Java, where the so-called 'fourth disease' was also present on P.O.J. 2878 and 2691; the last-named disorder appears to be transmissible through the setts. Pokkah-boeng (*Fusarium*) [*Gibberella moniliformis*: ibid., x, p. 751] was reported from East and West Java (where it is considered to be a contributory factor to the low standard of production), as well as from the Cheribon Subdivision of the Java Sugar Industry Experiment Station. The insignificant early occurrence of the disease developed in the last-named district into a severe and extensive top rot. The P.O.J. 2691 variety appears to be more susceptible to pokkah-boeng and red stripe [*Phytomonas rubrilineans*: ibid., xi, p. 327] than P.O.J. 2878. The so-called 'kalimati' disease [ibid., xii, p. 425] and 'spotty chlorosis' occurred locally in East Java.

'Spikkel' [leaf spot] of tobacco (*Cercospora nicotianae*) [ibid., xiii, p. 328] was prevalent in the Vorstenland, even on black dust ('zwarte stof') soils. In Besoeki a new disease, apparently caused

by a species of *Pythium*, caused heavy damage in some tobacco seed-beds.

Asterina camelliae was reported from Sumatra as the cause of a new leaf disease of tea. In the Patjet district of Java some 50 per cent. of the potato crop was affected by slime disease [*Bacterium solanacearum*], contracted both through contaminated seed from Bandoeng and from the soil.

Root rot [ibid., x, p. 298] was the most serious disease of rice in the Kedoe Residency, where a total area of 2,010 hect. was affected, the corresponding figures in Bodjonegoro and Besoeki being 18,516 and 700 hect., respectively.

The vanilla disease caused by *Gloeosporium* sp. [ibid., xiii, p. 58] in Kedoe was held in check by the application of Bordeaux mixture.

A species of *Diplodia* was identified at the Phytopathological Institute as the probable cause of the rotting and shedding of coco-nuts observed for the first time in 1931 on the west coast of Sumatra, where the number of affected palms increased from 3 in April to 200 in August. The diseased nuts could not be used for copra.

Pepper [*Piper nigrum*] in West Borneo suffered from a foot rot due to a species of *Phytophthora* which caused losses of up to 10 per cent. in certain plantations.

Black root rot (*Rosellinia bunodes*) was widespread in a Besoeki estate on *Desmodium gyroides*.

Mouldy rot (*Sphaeronema fimbriatum*) [*Ceratostomella fimbriata*] of *Hevea* rubber is stated to be no longer of any importance in Java except in the south of the east coast plantations and in Tapanoeli. Red root rot (*Ganoderma pseudoferreum*) caused severe damage on old rubber estates in Central Java.

Coffee was extensively attacked in Central Java by *Corticium javanicum* [*C. salmonicolor*: ibid., xi, p. 432], which also occurred in Malang, especially in densely planted areas.

Myers (J. G.). **Observations on a journey from the mouth of the Amazon to Mt. Roraima and down the cattle-trail to Georgetown.**—*Agric. Journ. Brit. Guiana*, v, 2, pp. 86–100, 1934.

In this account of a journey made in 1932 in the Amazon basin under the auspices of the Imperial Institute of Entomology, the Empire Marketing Board, and the Trinidad Sugar-Cane Investigation Committee the author states that near Pará and also along the main course of the Amazon almost as far up as Manãos cacao was heavily infected with witches' broom [*Marasmius perniciosus*: *R.A.M.*, xiii, p. 359], apparently not previously recorded from the Amazon region. In the Kanuku mountains true wild cacao (of exactly the same uniform type as the wild cacao seen by the writer on an affluent of the Coppername River in Surinam) was apparently completely unaffected by this disease.

The *Hevea* rubber nurseries, containing two and a half million seedlings, at Boa Vista, the settlement on the Ford rubber concession on the Rio Tapajoz, an affluent on the right bank of the Amazon, were affected by a troublesome leaf disease. The

settlement, begun only five years previously, already has 4,500 acres of thriving rubber trees planted out.

LUDWIGS (K.). **Hexenbesen an Kakaobäumen.** [Witches' brooms on Cacao trees.]—*Der Tropenpflanzer*, xxxvii, 5, pp. 198–203, 2 figs., 1934.

In 1933 the writer investigated the so-called 'witches' broom disease of cacao (attributed by v. Faber in 1908 to *Taphrina bussei*) [*R.A.M.*, xii, p. 207]) in the Cameroons. The disturbance, which is quite distinct from the South American witches' broom due to *Marasmius perniciosus* [see preceding abstract], is characterized by a generalized malformation of the entire crown, the periphery of which is particularly conspicuous by reason of the dense foliage. The condition would appear to be due rather to adverse physiological factors than to parasitic agency, and should be designated 'intensive or over-branching' in preference to 'witches' broom'. During 1933 weather conditions in the Cameroons were abnormal, the customary late winter to early spring drought being interrupted by excessively heavy rains, inducing premature growth. These were followed in March and April by an extremely dry spell, arresting development and causing extensive shedding of flowers, fruit, and foliage. The succeeding rainy period in May in its turn stimulated fresh growth and led to superfluous bud formation with the above-mentioned results. Cacao in the Ekona plantation showed a specially marked tendency to over-branching. The disorder is considered unlikely to cause any direct injury to the trees, which may, however, eventually suffer from exhaustion due to overproduction.

OSTERMAYER (A.). **Statistische Studien über das Auftreten und die Bekämpfung von Pflanzenkrankheiten.** [Statistical studies on the occurrence and control of plant diseases.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz*, xii, 3, pp. 61–71, 1934.

Statistical analyses, based on an evaluation of the relative importance of various environmental factors in the occurrence of plant diseases, were made from 1903–11 and again from 1917–32 on the incidence of cereal disorders in different parts of Austria, Czecho-Slovakia, and Hungary. During the first and second observation periods, respectively, 451 and 647 stands were inspected.

The first analytical data revealed the epidemic character of the cereal diseases on the farms visited in Moravia, where only 13·7 per cent. of the 451 stands could be classified as completely sound, the corresponding figures for slight, severe, and mass infection being 26·8, 39, and 20·5 per cent., respectively. From a consideration of the relative influence on disease of place of cultivation (approximation to, or deviation from, the 'ecological optimum'), climate, soil, and crop rotation it was found that these factors are operative in the order named. A site approaching the ideal is, therefore, the prerequisite condition for healthy growth. The subsidiary but yet important rôle of cultural measures in the promotion or prevention of disease is discussed with special reference

to blackleg and lodging of wheat [*Ophiobolus graminis* and *Cercosporella herpotrichoides*: *R.A.M.*, xiii, p. 569]. In confirmation of German observations the former disturbance appears from the writer's investigations to occur primarily on the lighter types of soil poor in certain nutrient elements, whereas the latter is more prevalent on richer ground. On both diseases a decisive influence is exercised by crop rotation, their incidence being lowest after black fallow and relatively slight following clover or beet. It is of the utmost importance that one of the two last-named, or some other legume or root crop, should be interposed between any cereal (more especially barley) and wheat. Contrary to statements in the literature, oats were found to be more detrimental than rye to the succeeding wheat crop [cf. ibid., xiii, p. 154].

BEVER (W. M.). **Physiologic specialization in Puccinia glumarum in the United States.**—*Phytopath.*, xxiv, 6, pp. 686–688, 1934.

Apart from the work of Hungerford and Owens [*R.A.M.*, iii, p. 266], there has been little or no evidence of more than one physiologic form of *Puccinia glumarum* in the United States until 1933, when the Red Russian wheat variety (C.I. 5409), which has always been immune from the form commonly present at Moscow, Idaho, showed susceptibility to the form prevailing in the Flathead Valley of Montana. Some months later a number of the wheats used by Gassner and Straib in their determination of physiologic forms of *P. glumarum* in Europe, together with some American wheat and emmer varieties, were inoculated with the Montana and Moscow forms under controlled conditions. Both Red Russian and Chinese 166 were found to differ from the remaining varieties in their reactions [which are tabulated] to the two collections of *P. glumarum*, being resistant to the Moscow form and susceptible to that from Montana. The latter is, therefore, believed to be a distinct physiologic form observed for the first time in the United States.

SIBILIA (C.). **Sulla costituzione biotipica della Puccinia triticina Erikss. in Italia.** [On the biotypical constitution of *Puccinia triticina* Erikss. in Italy.]—*Rendic. R. Accad. Lincei*, xix, Ser. VI, 1, pp. 53–55, 1934.

Two Italian collections of brown rust of wheat (*Puccinia triticina*), one from the Gran Sasso (1,300 m. above sea level) and the other from Rome, were shown by inoculation experiments on eight standard varieties to correspond to Scheibe's physiologic form XV [*R.A.M.*, xii, p. 619; xiii, p. 619].

SĂVULESCU (T.). **Die Beeinflussung der spezifischen Widerstandsfähigkeit und Empfänglichkeit des Weizens gegen Rost durch die Wirkung der äusseren Faktoren.** [The action of external factors as influencing the specific resistance and susceptibility of Wheat to rust.]—*Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz*, xliv, 6, pp. 257–309, 33 graphs, 1934.

No consistent inferences can be drawn regarding the influence of soil reaction on the occurrence and spread of brown rust of wheat (*Puccinia triticina*) from the author's investigations in Rumania [*R.A.M.*, xiii, p. 152]. In a general way, wheat is not

liable to this disease on neutral or alkaline soils, yet in 1932 it was just under such conditions that the rust attained its maximum severity and extent. In years of heavy precipitation (e.g., 1932), certain types of sandy soils that have a relatively high water-holding capacity are much more favourable to rust outbreaks than those of the dark forest type [cf. ibid., xiii, p. 83]. Prolific tillering, which may be induced by thorough autumn tillage, is an important means of reducing the incidence of *P. triticina*. Careful studies since 1928 of the so-called 'thermohydric factor', i.e., the combined effect on brown rust of temperature and moisture, have shown the significance of meteorological conditions during the critical phase of growth on the reaction of wheat plants to *P. triticina* ('thermohydric predisposition index'). Thus, the greater the number of rainy periods with coincident reduction of temperature during May and June, the higher will be the incidence of brown rust. Neither temperature nor moisture alone, however, is capable of modifying the reaction to brown rust in this manner.

TRAAEN (A. E.) & JØRSTAD (I.). **Kornavsopningsforsøk med kjemikalier i årene 1930–33.** [Seed-grain disinfection experiments with chemicals during the years 1930–33.]—Reprinted from *Meld. Statens frøkontroll i År 1932–33*, 24 pp., 1934. [English summary.]

The results are fully described and tabulated of experiments carried out in Norway from 1930–3 on the control by numerous liquid and dry disinfectants of wheat bunt (*Tilletia caries*), covered smut of barley (*Ustilago hordei*), oat smuts (*Ustilago kolleri* and *U. avenae*), and barley stripe (*Helminthosporium gramineum*), and notes on seed injury are given [cf. *R.A.M.*, ix, p. 638].

FRON (G.). **Nouveau essais de lutte contre la maladie du piétin du Blé.** [New attempts at the control of the foot rot disease of wheat.]—*Comptes rendus Acad. d'Agric. de France*, xx, 19, pp. 644–650, 1934.

In a recent test wheat (Bon Fermier) seed-grain dusted with neutral sulphate of ortho-oxyquinoline and subsequently inoculated with *Cercosporella herpotrichoides*, the chief agent of foot rot in France [*R.A.M.*, xii, p. 685; cf. also xiii, pp. 623, 626], produced a good, thick stand with few gaps, whereas the plots raised from infected, non-dusted seed-grain were practically destroyed by the disease. The spores of *Tilletia tritici* [*T. caries*] are unable to germinate in a solution of 1 in 1,000,000 oxyquinoline, the use of which against bunt is therefore also indicated.

SPRAGUE (R.). **The association of Cercosporella herpotrichoides with the Festuca consociation.**—*Phytopath.*, xxiv, 6, pp. 669–676, 2 figs., 1934.

The writer's investigations on the ecological associations of the foot rot of winter wheat and winter barley caused by *Cercosporella herpotrichoides* in certain prairie areas of Washington, Oregon, and Idaho [*R.A.M.*, xiii, p. 433 and preceding abstract] have shown that the fungus is almost exclusively confined to regions that originally bore a *Festuca* sod-grass consociation. Indicator plants

include *F. idahoensis* (dominant), bunch grass (*Agropyron* spp.), *Balsamorhiza* sp., *Delphinium menziesii*, *Lomatium* [*Peucedanum*] *triternatum*, and *Lithospermum ruderale* [*L. pilosum*].

Ruttle (Mabel L.) (Mrs. Nebel). **Studies on Barley smuts and on loose smut of Wheat.**—*New York (Geneva) Agric. Exper. Stat. Tech. Bull.* 221, 39 pp., 6 figs., 1934.

The examination of field and greenhouse collections of barley smuts from various parts of the United States and from Canada during the period from 1931 to 1933 showed the existence of five types [a brief description of which is given] intermediate between *Ustilago hordei* and *U. nuda*, of which type 4 corresponded closely to *U. medians* Biedenkopf (*Zeitschr. f. Pflanzenkr.*, iv, pp. 321–322, 1894) and *U. nigra* [*R.A.M.*, xii, p. 161]; types 2 and 3 were intermediate between type 4 and *U. hordei*, and types 5 and 6 intermediate between type 4 and *U. nuda*. In artificial inoculation experiments, Alpha barley was infected by all the smut collections that were tested, but Featherston barley was not infected by certain type 4 collections, and Tennessee Winter barley by *U. nuda* collected on Featherston in the greenhouse; in the same experiments, no infection was obtained on Reward wheat with *U. tritici* collected on Honor wheat in the greenhouse at Geneva, New York, nor on Honor with *U. tritici* collected on Garnet wheat in Manitoba (Reward form).

Details are further given of experiments in which type 3 smut was hybridized with *U. hordei* by inoculating dehulled barley seed with a monosporidial culture of each, belonging to the two sex groups found to be present in the sporidia isolated, and seed-grain obtained from flowers inoculated with *U. nuda* was inoculated with different bisporidial cultures of *U. hordei* or type 3. In describing the various types of infection which resulted in the plants of the latter series, mention is made of two plants from one culture, the heads of which contained, besides spores typical of *U. nuda* and type 3, other spores which were echinulate but germinated by promycelia and sporidia, and are suspected to be hybrid spores between type 3 and *U. nuda*.

Barley grain obtained from flowers inoculated with type 4 was not penetrated by the mycelium of the smut, and the resting sporidia and hyphae which developed on the surface of the caryopsis produced sporidia within 24 hours after the grain was put to germinate. Abundant mycelium, however, was present in the grains of Alpha and Featherston barleys which were obtained by flower inoculation with *U. nuda*, and in those of Honor and Reward wheats similarly inoculated with their own forms of *U. tritici*.

Sparrow (F. K.). **The occurrence of true sporangia in the Physoderma disease of Corn.**—*Science*, N.S., lxxix, 2060, pp. 563–564, 1934.

Physoderma zeae-maydis, the agent of brown spot of maize in the south-eastern United States [*R.A.M.*, xiii, pp. 225, 628], has recently been found by the writer to produce an abundance of thin-walled, irregular, extramatrical sporangia furnished with an intramatrical rhizoidal system. These organs, rather than the

thick-walled, brownish, elliptical or flattened intramatrical structures usually termed 'sporangia', are believed to correspond more exactly with the sporangia formed by certain other members of the Chytridiales.

If the zoospores developing from the thick-walled resting spores are placed with a piece of an unfolding maize leaf (Golden Bantam in these tests) in a hanging drop culture, many develop after three days into irregular, slipper-shaped structures anchored to the host cell by a coarse, branched, rhizoidal system arising from a small apophysis. At maturity a number of zoospores, sometimes exceeding 300, are produced within the sporangium thus formed from the body of the original zoospore and are eventually discharged through a broad pore formed after the deliquescence of a single apical papilla. These spores resemble those produced by the germinating resting spores but are much smaller (? gametes). Similar sporangia have been observed to occur in *P. menyanthis*, *P. butomi*, and *P. maculare*.

Lévy (Jeanne) & Bogdanovič (S. B.). **Sur quelques propriétés pharmacodynamiques d'Ustilago maidis.** [On some pharmacodynamic properties of *Ustilago maidis*.]—*Comptes rendus Soc. de Biol.*, cxvi, 22, pp. 590–592, 1 graph, 1934.

It was shown by experiments on laboratory animals that *Ustilago maidis* [*U. zeae*]. either in the form of a 10 or 20 per cent. macerated solution or in that of a fluid extract, is capable of modifying the pharmacodynamic properties of adrenalin, diminishing its vasoconstrictive renal action and transforming its inhibitory influence on the intestinal functions into a stimulatory one [cf. *R.A.M.*, xiii, p. 225]. Up to a certain point, therefore, the properties of *U. zeae* may be regarded as comparable to those of ergot of rye [*Claviceps purpurea*: ibid., xii, p. 88].

Fawcett (H. S.). **Is psorosis of Citrus a virus disease?**—*Phytopath.*, xxiv, 6, pp. 659–667, 3 figs., 1934.

An extended description is given of the writer's observations in California suggesting a virus origin for citrus psorosis, a summary of which has already been noticed from another source [*R.A.M.*, xiii, p. 90]. The spots on the young leaves may be up to about 3 mm. long by ½ to 1 mm. broad, while those sometimes seen on the older foliage are larger (up to 6 or even 10 mm. in diameter) and more circular. The bark of water sprouts occasionally shows spots resembling this last type. It is suggested that the virus may occur in either a localized or systemic form. Rooted leafy shoots from trees with severe psorosis gave plants with mottled foliage, while those similarly grown from healthy trees had normal leaves.

Parker (E. R.). **Effect of certain zinc sulphate sprays for mottle leaf of Citrus.**—*California Citrograph*, xix, 8, p. 204, 3 figs., 1934.

In further spraying tests against citrus mottle leaf in California [*R.A.M.*, xiii, p. 573] serious injury, including severe defoliation with leaf and fruit spotting, and death of the terminal buds, was

caused when navel and Valentia orange, lemon, and grapefruit trees were sprayed with zinc sulphate (5 to 20 lb. in 100 galls. water) without lime, but no damage resulted when the mixture used consisted of 10 lb. zinc sulphate and 5 lb. hydrated lime in 100 galls. water.

Cardoso (J. G. A.). **Mozambique: diseases and pests of Citrus in the district of Lourenço Marques.**—*Internat. Bull. of Plant Protect.*, viii, 6, p. 126, 1934.

Citrus canker (*Phytomonas* [*Pseudomonas*] *citri*) was not observed in the course of a phytosanitary inspection of the plantations in the Lorenzo Marquez district of Mozambique [*R.A.M.*, xiii, p. 544]. The following fungi, however, are responsible there for diseases requiring treatment: *Capnodium citri*, *Colletotrichum gloeosporioides*, *Pythiacystis* [*Phytophthora*] *citrophthora* [ibid., xiii, pp. 437, 630], *Rosellinia* sp., and *Sporotrichum citri* [ibid., xiii, p. 90].

Bitancourt (A. A.). **Stomiopeltis citri n.sp., agente da 'fuligem' dos Citrus no Estado de São Paulo.** [*Stomiopeltis citri* n.sp., the causal agent of 'sooty blotch' of Citrus in the State of São Paulo.]—Reprinted from *Arq. Inst. Biol. de Defesa Agric. e Animal*, São Paulo, v, 12 pp., 2 pl., 1934. [English summary.]

This is a detailed morphological and taxonomic account of a fungus, considered to be new to science, which causes sooty blotch on citrus green shoots, leaves, and fruits in the State of São Paulo and other localities of Brazil. Sweet and sour oranges, lemons, and *Citrus trifoliata* are amongst the species affected. On the affected organs the fungus forms a superficial, reticulate mycelial web, bearing both thyriothecia (shield-like perithecia) and pycnidia. The thyriothecia are sparse, rounded, lenticular-scutate, pale brown, 140 to 200 μ in diameter, with a pseudo-ostiole in the centre. The asci, immersed in a paraphysoid tissue, are clavate or cylindrical, prostrate, disposed radially with their apices converging towards the centre of the conceptacle, and measure 22 to 46 by 6·5 to 11 μ. The ascospores are hyaline, two-celled, somewhat constricted at the septum, straight, and 6 to 11 by 2 to 4 μ. The pycnidia are 80 to 150 μ in diameter, and contain hyaline, cylindrical, catenulate spores, 2·5 to 6·5 by 0·5 to 1·2 μ. The two stages are named *Stomiopeltis citri* n.sp. and *Sirothyrium citri* n.sp., respectively, with Latin diagnoses. A brief description, with Latin diagnosis, is also given of a variety, named *minor*, of the ascigerous stage which was observed on the green organs and fruits of oranges.

Bitancourt (A. A.). **As manchas das Laranjas. Descrição das principais manchas, podridões e outras alterações das Laranjas, e dos meios para combatê-las.** [Orange spots. A description of the chief spots, rots, and other disorders of Oranges, and of measures for their control.]—*Inst. Biol. Defesa Agric. e Animal, São Paulo, Folh.* 53, 135 pp., 6 col. pl., 57 figs., 1934.

This very useful publication gives semi-popular descriptions of the chief spots, rots, and other defects of oranges caused in Brazil

by fungal and insect parasites, environmental factors, or physiological disorders. Most of the well-executed illustrations, including the coloured plates, are original. A special chapter deals at some length with remedial measures, including instructions for the preparation and application of fungicidal and insecticidal sprays, and a calculation of the cost of the various treatments under local working conditions.

Fifield (W. M.). **The effect of various wrappers on the preservation of Oranges in cold storage.**—*Proc. Florida State Hort. Soc., 1932*, pp. 57–60, [? 1933. Abs. in *Chem. Abstracts*, xxviii, 15, p. 4799, 1934.]

Plain, relatively heavy aluminium foil, embossed aluminium foil of the same weight, and plain, thin aluminium foil, as well as moisture-proof and S.S.T. cellophane [cf. *R.A.M.*, x, p. 253] proved far superior to plain, oiled, waxed, parchment, or copper sulphate-treated paper wrappers in reducing loss of weight in oranges during storage. The fruit wrapped in aluminium foil or cellophane kept in good condition for three to five months compared with only six weeks for that in paper coverings.

Bliss (D. E.). **Symptoms of decline disease.**—*Tenth Ann. Rept. Date Growers' Inst.*, p. 10, 1933. [Received September, 1934.]

One of the first symptoms of the 'decline' disease of Deglet Noor date palms in California [*R.A.M.*, xi, p. 572] is the premature death of leaves in the lower whorls. The rate at which new leaves appear is also greatly reduced, and during warm periods in August and September affected trees lose many more leaves than healthy ones, the leaves on the former rapidly turning brown and the petioles becoming tough and shrunken. Terminal growth becomes arrested or retarded, and the leaves (which point stiffly upwards, giving the top of the palm a flattened, brush-like appearance) are yellowish-green, the petiole being narrow and weak and the midrib and pinnae slender and shortened. Affected trees commonly have not more than ten bunches of dates, as against fifteen or twenty on healthy ones; the spathes are small and often appear late, and the fruit stalks are sometimes barely an inch wide and much weakened. The flowers remain normal, but the fruits, when those on healthy trees are ripe, are hard, fibrous, brittle, and shrivelled at the tip. The trunk, leaves, and fruit are stunted but free from lesions. Decay, usually associated with necrotic tissues, may extend from the roots into the base of the tree, but the disease does not appear to terminate fatally.

Bliss (D. E.). **Investigations on the cause of decline disease in Date Palms.**—*Eleventh Ann. Rept. Date Growers' Inst.*, pp. 4–6, 1934.

The 'decline' disease observed on Deglet Noor date palms in the Coachella Valley, California, about 1921 [see preceding abstract], though spreading to healthy trees of this variety in adjoining rows and other plantings, has not attacked the Zahidi, Kustawy, Halawy, Tazizaoot, or Iteema varieties. Badly affected trees show up to 90 per cent. of dead roots. In inoculation tests with numerous

fungi isolated from decayed roots only a species of *Omphalia* was strongly pathogenic to unwounded underground portions of seedling palms, palms in the two-leaf stage frequently being killed within fourteen days of inoculation, while older plants died after a longer interval or remained stunted. One culture of *Omphalia* produced lesions on 68 out of 79 potted Deglet Noor seedlings. The leaves wilted and died, necrotic lesions developed in the primary roots, and the young roots were often killed while emerging through the leaf sheaths at the base of the palm and before they reached the soil; fungal invasion of the base of the trunk followed and the young palms died as a result of attack on the meristematic tissue of the terminal bud. In larger palms the trunk was seldom affected to a depth of over one inch, and, as a rule, death did not result. When three-year-old palms growing in the field were exposed to infection by inoculating the soil at their bases with *Omphalia* they all became severely affected in four months, though similar palms in uninoculated soil remained healthy. The fungus was not found on healthy palms.

MAYNE (W. W.). **Some notes on Burgundy mixture and Burgundy injury.**—*Planters' Chron.*, xxix, 11, pp. 255–259, 1934.

In southern India several reports were received during the past year of injury sustained by coffee plants sprayed with Burgundy mixture. Although Bordeaux mixture is usually recommended as a spray for coffee, Burgundy mixture has found favour in some districts, presumably owing to the absence of grit and the smaller quantity of the alkaline ingredient required. The standard mixture consists of 5 lb. copper sulphate, $2\frac{3}{4}$ lb. soda ash (or $6\frac{1}{4}$ lb. washing soda), and 50 galls. water. Mixtures made with satisfactory materials in the correct proportions are approximately neutral; they become acid or alkaline according as an excess of copper or soda, respectively, is present.

The injuries caused by Bordeaux and Burgundy mixtures fall into three groups, namely, those due to acid (excess copper), alkaline (excess lime or soda), or normal mixtures. The first is the most serious of these forms of injury and is much more usual than the second. In an experiment in which Burgundy mixture made with materials combined in six different proportions was tested on coffee, no damage resulted at any strength from 5–$2\frac{1}{2}$–50 to 5–5–50. The problem of the injuries caused by normal neutral Burgundy mixtures is very complex, damage depending on the kind and vigour of the plant sprayed, the weather before and after the spraying, and the heaviness and strength of the mixture. The effects produced on plants very susceptible to spray injury show clearly that Burgundy is a more dangerous spray than Bordeaux mixture.

On the whole, coffee does not appear to be very liable to spray injury. No authentic instance of injury to this crop by properly prepared Bordeaux mixture has been seen at the Coffee Experiment Station, Mysore, nor has any report of such injury been received. Injury due to Burgundy mixture is unlikely to be common, but it may occur without any defect in the materials or the making. As a protective spray for coffee Bordeaux is preferable to Burgundy mixture, being safer and slightly more effective as a fungicide.

MASSEY (R. E.). **Section of Botany and Plant Pathology, G.A.R.S. Final Report on experimental work in 1932–33.**—*Ann. Rept. Gezira Agric. Res. Serv. for the year ended 31st December, 1933*, pp. 126–146, 1 plan, 4 graphs, [1934. Mimeographed.]

Exceptionally heavy rains in the Gezira, Sudan, in June, 1933, greatly favoured the persistence of ratoon growth from the stumps in the previous year's cotton land. In many cases the ratoons were already affected with leaf curl [see next abstract], and the presence of large numbers of whiteflies [*Bemisia gossypiperda*] led to rapid infection of the new crop. As chopping at ground level offered an inadequate means of clearing the old crop, a hand tool by which the whole plant and root could be pulled up was devised, the principle of which was adopted by the Sudan Plantations Syndicate, Ltd., who with a modified model of their own design disposed of the remains of the entire crop at the end of the season.

A quantitative examination made in conjunction with the Plant Observation Section of healthy and leaf curl plants of the same age, size, and development showed that the reduction in yield caused by the disease amounted to up to 50 per cent.

In two successive seasons some 40,000 well grown cotton plants were raised in an isolated area from seed taken from badly diseased leaf curled plants without any occurrence of leaf curl in the offspring.

Fusarium solani was isolated from the fine rootlets of wilting cotton [*R.A.M.*, xi, p. 513]. *Macrophomina phaseoli* [see above, p. 683] caused widespread seedling infection but little eventual loss of crop.

The amount of blackarm [*Bacterium malvacearum*: ibid., xii, p. 91] developing on the new season's cotton at the Gezira Research Farm between 30th October and 9th November, 1932, was ascertained to be directly influenced by the position of the plot in relation to the previous year's cotton, infection being worst on land adjoining that on which cotton was grown the previous year, in which infected debris might be expected to occur. Investigations into the persistence of *Bact. malvacearum* in plant remains and the possibility of destroying it therein by flooding [ibid., x, p. 662] showed that when heavily infected debris was spread on the soil and the plots resown after being completely flooded there was no recurrence of the disease.

When strips of cotton were sown in concentric arcs at increasing distances from badly infected cotton in an adjacent plot, the sector of the circle bordering the arcs being divided into two equal portions, in one of which the natural growth of weeds was left untouched, in the weeded sections the organism spread to a distance of 217 yards, whereas in the others it spread only 90 yards, the weeds evidently acting as barriers to spread.

No seed-borne infection occurred in the Gezira wherever disinfected (with abavit B) seed was sown. Where clean seed was sown the source of new infection by blackarm was normally the adjacent plot on which cotton had been grown during the previous season.

Consistent evidence was obtained that rough colony forms of *Bact. malvacearum* are non-pathogenic, whereas smooth forms are

pathogenic but become feeble with age. The bacteriophage was again recovered from infected soil [loc. cit.] but was not found in clean areas. Permanent clearing of broth cultures of the rough forms was repeatedly given by the bacteriophage extracted from soil, but the clearance of cultures of the smooth forms was invariably temporary.

An aqueous solution at 1 in 1,000,000 of four parts mercuric chloride and one part mercuric iodide inhibited the growth of *Bact. malvacearum* in five minutes and killed it in fifteen minutes; no other compound tested was so lethal.

COWLAND (J. W.). **Gezira Entomological Section, G.A.R.S. Final Report on experimental work, 1932–33.**—*Ann. Rept. Gezira Agric. Res. Serv. for the year ended 31st December, 1933*, pp. 107–125, 1 graph, [1934. Mimeographed.]

In an experiment conducted in the Gezira, Sudan, whiteflies (*Bemisia gossypiperda*) previously infected with the cotton leaf curl virus [*R.A.M.*, xi, pp. 452, 573, and preceding abstract] were fed for one to nine days on the immune lubia [*Dolichos lablab*] or on clean Sakel plants and then transferred to healthy Sakel seedlings. Successful transmission of the disease resulted for all the periods of clean feeding tested, provided that not fewer than 50 to 100 individuals were used. Experimental evidence was obtained that cotton plants are not viruliferous earlier than one day before the appearance of definite vein thickening. It was ascertained that cotton is susceptible to leaf curl at all stages of growth, but in older plants the development of the disease is considerably delayed or does not occur until secondary growth begins. A study of the differential resistance of cotton and related plants to infection derived from different sources was carried out by transmitting the leaf curl virus by large numbers of whiteflies from the susceptible Giza 7 cotton variety, Gezira Main Crop cotton, the resistant cotton variety XH 1029, *Hibiscus esculentus*, *H. cannabinus*, and weika (an annual variety of *H. esculentus*) to each of these plants. The results clearly indicated that XH 1029 maintained its resistance no matter what source of infection was employed, that when itself infected it is much less capable of passing on infection to other hosts than any of the other plants tried except *H. esculentus*, that *H. esculentus* only feebly transmits leaf curl, and that *H. cannabinus* is very susceptible and transmits the disease very readily.

Annual Report of the Indian Central Cotton Committee, Bombay, for the year ending 31st August, 1933.—155 pp., 1 pl., 1934.

The following items of phytopathological interest occur in this report. The work of the Punjab cotton root rot scheme [*R.A.M.*, xii, p. 567] showed that the disease is mainly due to two species of *Rhizoctonia* which ceased to grow at 40° and 45° and died at 60° and 68° C., respectively; they are very tolerant of acidity and alkalinity and may remain dormant in the soil for a long time. In August, 1933, the Baroda root rot scheme was extended for a further period of three years. In this district three organisms appear to be involved in the causation of root rot, viz., a nematode, *Fusarium vasinfectum*, and *R. bataticola* [*Macrophomina phaseoli*:

see above, p. 696]. Plants affected by this form of root rot die from top to bottom, in contrast to those attacked by wilt (*F. vasinfectum*), which wither from the base upwards. None of the progeny of numerous plants from heavily infested fields gave evidence of resistance to root rot. In Broach and Jalgaon five-year breeding schemes have been in progress since 1931 with a view to the development of wilt-resistant cottons with good yielding, ginning, and spinning qualities. 'Red leaf' and leaf roll of American cottons appear to be associated with a definitely lower osmotic pressure in the diseased foliage.

WARE (J. O.) & YOUNG (V. H.). **Control of Cotton wilt and 'rust'.** —*Arkansas Agric. Exper. Stat. Bull.* 308, 23 pp., 1934.

The following cotton varieties have been found suitable for Arkansas conditions and extremely resistant to wilt (*Fusarium vasinfectum*) [*R.A.M.*, xi, p. 638]: two types of Dixie-Triumph (Watson and Marett), Dixie 14, Lightning Express, Super Seven (Coker), and Miller. Moderately resistant or wilt-tolerant are Arkansas Rowden 40, 2088 and 2119, Arkansas 17, D. & P.L. 4 and 6, Express 121, Cleveland 54, and Wilson Type Big Boll. Many of the promising newer strains, on the other hand, e.g., Delfos, Stoneville, Acala, and Qualla, proved highly susceptible to the disease under experimental conditions and are therefore undesirable for use where the disease is severe. Further work on the combined control of wilt and 'rust' or potash hunger indicated that the best result may be expected from the application of a mixed fertilizer containing relatively large amounts of potash.

EZEKIEL (W. N.) & TAUBENHAUS (J. J.). **Comparing soil fungicides with special reference to Phymatotrichum root rot.**—*Science*, N.S., lxxix, 2061, pp. 595–596, 1934.

Of a number of volatile chemicals recently tested in the laboratory for their toxicity to the root rot fungus (*Phymatotrichum omnivorum*) in Texas, pentachlorethane, tetrachlorethane, and xylene proved the most effective. In a preliminary field test, tetrachlorethane placed in the soil at a depth of 6 in. destroyed the fungus on cotton roots to depths of at least 2 ft.

HILL (S. B.), YOTHERS (W. W.), & MILLER (R. L.). **Effect of arsenical and copper insecticides on the natural control of whiteflies and scale insects by fungi on Orange trees in Florida.**—*Florida Ent.*, xviii, 1, pp. 1-4, 1934. [Abs. in *Rev. Appl. Entomol.*, A, xxii, 8, p. 455, 1934.]

Tests were made of the effect of lead arsenate and copper compounds as used against *Ceratitis capitata*, on the control effected by the entomogenous fungi attacking Aleyrodidae [including *Aschersonia aleyrodis*, *A. flavocitrina*, and *Aegerita webberi* on *Dialeyrodes citri*] and purple scale (*Lepidosaphes beckii*) [by *Sphaerostilbe coccophila*] on orange trees in Florida [*R.A.M.*, iii, p. 579; vi, p. 419; xii, p. 568].

It was found that lead arsenate, cryolite, and potassium aluminium fluoride at the concentrations used permitted an increase of Aleyrodidae amounting after eight months to between 1½ and

5 times that of the infestation on untreated trees, the corresponding figures for the copper compounds being 5 to 10 times. The natural fungus control of Aleyrodidae in unsprayed groves may be as high as 90 per cent. whereas only 40 to 50 per cent. can be expected where copper-containing sprays, e.g., Bordeaux mixture, are applied. The population of *L. beckii* on trees sprayed with copper compounds was nearly twice as great as that on untreated, Bordeaux mixture (4-4-50) allowing the heaviest increase, closely followed by copper carbonate. The natural control of 60 per cent. to be anticipated in unsprayed groves is reduced to 20 per cent. in those treated with Bordeaux mixture.

LAKON (G.). **Entomophthoraceen-Studien I–IV.** [Studies on Entomophthoraceae I–IV.]—*Zeitschr. Angew. Entom.*, xxi, 1, pp. 89–95, 1934.

From a detailed consideration of the taxonomic position of the fungus described by Speare (*Rept. Exper. Stat. Hawaiian Sugar Planters' Assoc., Bull.* 12, p. 14, 1912) as *Entomophthora pseudococci* n. sp. on *Pseudococcus calceolariae*, the writer concludes that this organism is identical with *Lamia apiculata* (Thaxt.) Lakon (*Zeitschr. Angew. Entom.*, v, p. 161, 1919), originally described by Thaxter in 1888 as *Empusa apiculata*, the insignificant differences observed by the first-named worker being insufficient for the establishment of a new species.

Discussing the classification of the insectivorous Entomophthoraceae, the writer favours the retention of the three genera, *Empusa*, *Lamia*, and *Entomophthora*, the last-named being characterized, in contrast to the others, by more or less profusely branched conidiophores. Specially characteristic of *Lamia* are the predominantly simple conidiophores and the presence of rhizoids.

German diagnoses are given of *Entomophthora blunckii* n. sp. on *Plutella maculipennis* and *Tarichium* (a provisional form genus) *hylemyiae* n. sp. on *Hylemyia coarctata*. The former is characterized by pale greenish-yellow, elliptical conidia, 15 to 22 by 8 to 11 μ (average 19 by 9 μ), borne on branched, grey to greenish-yellow conidiophores, 8 to 10 μ in width, accompanied by a few rhizoids. The latter may be recognized by resting spores (azygospores), 60 μ in diameter, arising on short hyphal elements within the body of the host and furnished with a thick, echinulate, pale orange-yellow membrane.

MCMARTIN (A.). **The locust fungus. Further observations.**—*South African Sugar Journ.*, xviii, 6, pp. 329, 331, 1934.

The natural occurrence of *Empusa* [*grylli*: *R.A.M.*, v, p. 93; xiii, p. 656] on the redwing locust [*Locusta migratoria migratorioides*] is stated to be widespread and of increasing intensity throughout the cane belt of Natal. In the normal course the external growth of the fungus appears shortly after death between the abdominal segments; in one case examined locusts dying about 5 p.m. showed an extensive external development by 11 p.m. Fungal growth continues as long as damp conditions are maintained, until finally the insect disintegrates. The pale yellow conidia of the fungus are produced in such numbers as to give a glistening,

powdery aspect to the surface of the growth, whence they are shot off and adhere to any object on which they fall.

In order to obtain a profusion of conidia a dry atmosphere is required; dried locusts killed by the fungus are covered with the yellow powder in such quantity that it may be scraped off with a knife, while the leaves to which the insects cling also bear masses of the conidial dust. Conidial germination is dependent on moisture, but it is not known how the living insects become infected. So far, the results of inoculation experiments under controlled conditions are inconclusive, and research is considerably hampered by the lack of artificial cultivation of the fungus. The redwing locust appeared in Natal in 1894, to be followed a year later by *E. grylli*; in 1899 and 1900 both the insect and its natural enemy were present. There is no doubt that the fungus does act as a check on the locusts, but the full extent of its utility in this field cannot yet be determined.

Daniel (G. E.). **Studies on Ichthyophonus hoferi, a parasitic fungus of the herring, Clupea harengus. I. The parasite as it is found in the herring.**—*Amer. Journ. of Hygiene*, xvii, 1, pp. 262–276, 15 figs., 1933.

Reference to this paper has already been made in the account by F. F. Fish of the herring (*Clupea harengus*) disease due to *Ichthyophonus* [*Ichthyosporidium*] *hoferi* [*R.A.M.*, xiii, p. 576]. The following is the life-cycle tentatively suggested by the author for the parasite. From the large, polynucleate cysts (up to 50 μ in diameter) in the infected fish, one or more hyphae, up to several hundred microns long, are produced, the cytoplasm leaving the cyst capsule and concentrating in the hyphae. Discrete, spherical, uni- to polynucleate spores of variable size are formed on the division of the hyphal cytoplasm and liberated by the rupture of the hypha at its distal end. Alternatively to this series of phases, the cytoplasm of the mother cyst may begin to fragment and the wall is ruptured to liberate a plasmodium-like body in the host tissue. By further fragmentation, bodies consisting of a nucleus surrounded by a small quantity of cytoplasm are formed and ultimately develop into polynucleate cysts capable of repeating either of the processes outlined.

Schmidt (P. W.). **Dermatomykosen.** [Dermatomycoses.]—*Dermatol. Zeitschr.*, lxix, 3, pp. 161–173, 1934.

The writer lists and briefly discusses the principal contributions to the study of the dermatomycoses that appeared during 1933, under the general headings of botanical, cultural, and microscopic examination, experimental biology, general, floristic (frequency statistics), and clinical observations.

Ciferri (R.) & Redaelli (P.). **Sporendonema epizoum (Corda) Cif. et Red.; an entity including Hemispora stellata and Oospora d'agatae.**—*Journ. Trop. Med. & Hygiene*, xxxvii, 11, pp. 167–70, 1934.

A complete Latin diagnosis is given of *Sporendonema epizoum* (Corda) Cif. et Red. n. comb. (*Torula epizoa* Cda), the synonyms of

which include *Hemispora stellata* [*R.A.M.*, xii, p. 444], *Oospora d'agatae* [ibid., xii, p. 218], *Torula fuliginea*, *T. pulchra* [both regarded, with some other fungi, as identical with *T. sacchari* by Van Luijk: ibid., viii, p. 66], and a number of other names. A brief account is given of the morphological and cultural characters of the fungus, supplemented by a taxonomic discussion of its identity and notes on its somewhat doubtful pathogenicity to man and animals, a full description being reserved for publication in an Italian journal.

Montpellier (J.) & Catanei (A.). **Résultats de l'étude d'un nouveau mycétome du pied observé à Alger.** [Results of the study of a new mycetoma of the foot observed at Algiers.]—*Bull. Soc. Path. Exot.*, xxvii, 3, pp. 209–214, 1 fig., 1934.

A fungus characterized by white, downy colonies, elongated or ovoid, sessile or subsessile conidia measuring 5·5 by 3 μ, and lateral or terminal ovoid chlamydospores, 2·5 μ in diameter, was isolated from a mycetoma on the foot of an Algerian native in 1933. The barley grain medium of Langeron and Milochevitch [*R.A.M.*, ix, p. 781] proved eminently suitable for the culture of the organism, which was identified as *Acremonium potroni* Vuillemin.

Schmidt (P. W.). **Über die Scherflechte bei Rindern. (Die in Westfalen ursächlichen Trichophytonarten und durch sie hervorgerufenen atypischen Hauterscheinungen).** [On ringworm in cattle. (The species of *Trichophyton* involved in Westphalia and the atypical skin manifestations caused by them).]—*Dermatol. Wochenschr.*, xcviii, 1, pp. 9–13, 3 figs., 1934.

Trichophyton rosaceum was found to predominate as the cause of ringworm among the cattle belonging to patients treated for the disorder at the Münster (Westphalia) University Skin Clinic [*R.A.M.*, xiii, p. 237], *T. faviforme* [ibid., xiii, p. 511] and *T. gypseum asteroides* [*T. mentagrophytes*] being only occasionally found on the animals. Attention is drawn to the completely atypical forms frequently assumed by ringworm in cattle, and to the resulting risk of infection by their unsuspecting owners.

Schwartz (W.) & Kaess (G.). **Das Wachstum von Schimmelpilzen auf gekühltem Fleisch bei verschiedenen Luftzuständen.** [The growth of moulds on chilled meat in various atmospheric conditions.]—*Arch. für Mikrobiol.*, v, 2, pp. 157–184, 1 fig., 1 diag., 8 graphs, 1934.

At the Karlsruhe Technical Institute pieces of meat were inoculated with *Penicillium flavo-glaucum*, *Mucor racemosus*, and *Cladosporium herbarum*, all prevalent in the atmosphere of slaughter-houses and cold storage rooms [*R.A.M.*, xiii, p. 442], and exposed to temperatures of 0°, 3°, and 6° C. at a humidity range of 75 to 100 per cent. *M. racemosus* was found to make the most rapid growth and *C. herbarum* the slowest, conidial development in the former reaching a maximum at 6°, with high atmospheric humidity. *M. racemosus* was found to overgrow an area of 3 sq. cm. in 11 days at 0°, whereas *P. flavo-glaucum* and

C. herbarum required 30 and 32 days, respectively, to cover the same space.

It is apparent from these data that *M. racemosus* was, in this case, the decisive factor in curtailing the period during which the meat could safely be held in cold storage, and that the results of experiments in its control may be generally applied to other meat moulds without appreciable modifications. The reduction of atmospheric humidity below the optimum for mould growth of 95 per cent. is not considered to be a practicable control measure under present-day storage conditions owing to its adverse effect on the constitution of the meat.

KAESS (G.) & SCHWARTZ (W.). **Untersuchungen über den Einfluss der Luftbewegung auf das Wachstum von Schimmelpilzen auf gekühltem Fleisch.** [Investigations on the influence of the circulation of air on the growth of moulds on chilled meat.]—*Arch. für Mikrobiol.*, v, 3, pp. 443–450, 1 diag., 3 graphs, 1934.

The exposure of meat inoculated with *Penicillium flavo-glaucum* and *Mucor racemosus* [see preceding abstract] to an air current of 5 and 12 cm./sec. at temperatures of 6° and 3° C. and an atmospheric humidity of 90 per cent. delayed the growth of the moulds to a certain extent, but not enough appreciably to lengthen the storage period. The favourable effect of the air current is attributable rather to the production of a correct balance between temperature and humidity relations than to a direct action on the moulds.

BURGESS (R.). **Causes and prevention of mildew on wool.**—*Journ. Soc. Dyers & Colourists*, l, 5, pp. 138–142, 1934.

Among the factors briefly discussed as contributing to the development of mildew on wool [cf. *R.A.M.*, xii, p. 24] may be mentioned treatment of the material with peroxide and intensive chlorination. Bacterial action, as opposed to that of moulds, has recently been shown to occur only at very high humidities. In a controlled atmosphere of under 100 per cent. relative humidity, the common moulds do not act as precursors of bacterial invasion. The distribution of fungi throughout a mildewed cheese of yarn in storage denotes over-conditioning, whereas the presence of numerous bacteria denotes a prolonged state of actual wetness.

Of the antiseptics applied for the prevention of mould growth during the winding process, preventol liquid and 2 per cent. shirlan NA [ibid., x, p. 598] have given the most promising results with superior Botany wool. Applied in backwashing, 0·7 per cent. shirlan NA gave four weeks' protection on Botany yarns, while similar results were obtained on crossbred wools with 0·6 per cent. shirlan NA, 0·67 per cent. sodium-*o*-phenylphenate, and 1 per cent. sodium silicofluoride with the addition of 0·1 per cent. igepon A paste. The addition of shirlan NA to a half-and-half mixture of olive oil and water, adjusted so as to give 3 per cent. oil and 0·2 per cent. antiseptic on the wool, conferred marked protection over

22 days, while a still better effect was obtained by the use of 5 per cent. Special Spinning Oil with the addition of 0·15 per cent. shirlan paste [ibid., xi, p. 679]. Other beneficial treatments deserving of further consideration include the use, e.g., in the form of crystals, of volatile antiseptics, bleaching with sulphur dioxide, chroming, and treatment with eulan NK [ibid., x, p. 598]. The substitution of bakelite cones for the cheap paper ones commonly used in winding gives good control of the mildew contracted through this source, but here expense is a limiting factor.

The paper (read at a meeting of the West Riding Section of the Society at Bradford on 7th December, 1933) was followed by a discussion.

WESTCOTT (CYNTHIA). **Brand canker of Rose, caused by Coniothyrium wernsdorffiae Laubert.**—*Cornell Agric. Exper. Stat. Memoir* 153, 39 pp., 5 pl., 2 figs., 6 graphs, 1934.

After a brief historical account of brand canker (*Coniothyrium wernsdorffiae*) of the rose [*R.A.M.*, xii, p. 633] in various parts of the world, the author gives a summarized report of four years' investigation of the disease in America, most of the research work having been done at Ithaca, New York. A comparative description is given of the symptoms of brand and stem canker (*C. fuckelii*) [*Leptosphaeria coniothyrium*: loc. cit.], and the characters distinguishing the two are indicated. Further, *C. wernsdorffiae* was shown to have larger pycnidia and larger spores (4·2 to 8·4 by 3·6 to 7·2 μ, as compared with 2·4 to 4·8 by 2·4 to 3·6 μ) than those of *L. coniothyrium*, the significance of the difference in spore measurements being statistically established [cf. ibid., ix, p. 722]. *C. wernsdorffiae* has also lower optimum and maximum temperatures for growth and develops more slowly than *L. coniothyrium*. Examination of the type specimen of *C. rosarum* [loc. cit.] at the Kew Herbarium indicated that it may not be identical with *C. fuckelii*, but the canker-forming fungus identified by Vogel as *C. rosarum* may be *C. fuckelii*, as suggested by Waterman [loc. cit.].

As regards the pathogenicity of *C. wernsdorffiae*, the fungus was capable of attacking any variety of rose treated as a climber in the garden at Ithaca, and no outstanding differences in susceptibility were noticed. While some tea varieties proved to be susceptible on inoculation, this group remained free from natural infection. Infection usually occurs in late winter or early spring through a break or wound in the epidermis during the period when the rose stocks are protected against winter conditions with earth or other covering around the base; infections were few or absent in plants left uncovered throughout the winter, indicating an easy method for the almost complete control of the disease, which was shown not to be amenable to control by spraying or dusting with fungicides during the growing season, or the application of lime-sulphur as a dormant spray late in the autumn. Observations during two years showed no correlation between non-protection of the rose plants and poor overwintering in the majority of the 76 varieties thus tested.

JERMIESS. **Bekämpfung von Asternkrankheiten.** [The control of Aster diseases.]—*Ratschläge für Haus, Garten, Feld*, ix, 6, pp. 107–108, 1934.

In a well-known horticultural district near Hamburg the profitable aster [*Callistephus chinensis*] trade is stated to be threatened by the *Fusarium* disease [in which several species appear to be involved: *R.A.M.*, xi, p. 718; xii, pp. 448, 633]; the losses from this source in many nursery-gardens amount to 70 per cent. Good control has been obtained by fertilizing with lime, phosphorus, and potash in preference to nitrogen, immersion of the seed in 0·25 per cent. uspulun, seed-bed disinfection three weeks before sowing with uspulun (75 gm. in a sufficient quantity of water for the thorough moistening of 1 sq. m.), washing the frame windows with 0·25 per cent. uspulun, dipping the roots of the seedlings before transplanting in a loam-uspulun emulsion, and (in cases of heavy soil infestation) pouring a 0·25 solution of uspulun into the plant holes.

EMSWELLER (S. L.) & JONES (H. A.). **The inheritance of resistance to rust in the Snapdragon.**—*Hilgardia*, viii, 7, pp. 197–211, 5 figs., 1934.

Snapdragon (*Antirrhinum majus*) rust (*Puccinia antirrhini*) [*R.A.M.*, iii, p. 721; xiii, p. 445], first observed in California in 1896, appeared near Chicago in 1913 and subsequently spread practically all over the United States. In 1930, very high resistance was shown by several plants grown in badly infected areas in California from resistant seed selections made in Indiana. Progenies from these, open pollinated, were grown in various parts of California and gave several resistant plants. Some of the latter were self-pollinated in 1931 and a few were crossed with known susceptible varieties. When the seed from these was grown on in 1932 evidence was obtained that resistant plants were of two types, one homozygous for resistance and the other heterozygous. Resistance was governed by a single dominant gene, but modifying genes are also present.

Transfer of the resistant gene to commercial varieties by the back-cross method has already given very encouraging results.

PAPE (H.). **Die Botrytiskrankheit der Lilien.** [The *Botrytis* disease of Lilies.]—*Blumen- und Pflanzenbau verein. mit Gartenwelt*, xxxviii, 28, p. 363; 29, p. 387, 2 figs., 1934.

A popular account is given of the symptoms, mode of infection, and control of the *Botrytis* disease of lilies, associated with *B. elliptica*, *B. hyacinthi*, and *B. cinerea* [*R.A.M.*, xi, p. 108; xiii, p. 165], in Schleswig-Holstein, where a stand of *Lilium candidum* was destructively attacked in 1933. Reports from the United States indicate that *L. longiflorum*, *L. candidum*, *L. chalcedonicum*, and *L. testaceum* are among the most susceptible varieties, *L. callosum*, *L. concolor*, *L. hansonii*, *L. japonicum*, *L. martagon*, *L. pyrenaicum*, and *L. willmottiae* being comparatively resistant. All the aerial portions of the plant are affected by the disease, which is

characterized by a grey to brown or orange spotting of the foliage followed by a soft rot of the leaves and stems.

Ikata (S.) & Hitomi (T.). **Studies on the putrefaction disease of edible Lilies.**—*Rept. Agric. Exper. Stat. Okayamaken Extra No.* 39, 16 pp., 5 pl., 1933. (Japanese.) [Abs. in *Japanese Journ. of Botany*, vii, 1–2, p. (6), 1934.]

Botrytis elliptica [see preceding abstract] is stated to cause a leaf spot of lilies grown for food in Okayamaka, Japan, eventually leading to the death of the entire plant, the edible bulbs of which are much esteemed. Infection appears to take place directly through the leaf cuticle without the aid of wounding. The fungus spreads more rapidly on the lower than on the upper surface, owing partly to the lesser thickness of the former and also to the presence on it of stomata, which are absent from the latter.

Nicolas (G.) & Aggéry (Mlle B.). **Sur les relations qui existent entre Daphniphyllum glaucescens, Phyllosticta daphniphylli et des bactéries et sur un type assez fréquente de maladie bactérienne.** [On the relations existing between *Daphniphyllum glaucescens*, *Phyllosticta daphniphylli*, and bacteria, and on a fairly common type of bacterial disease.]—*Bull. Soc. Hist. Nat. Toulouse*, lxv, 2, pp. 354-362, 3 figs., 1933. [Received May, 1934.]

This is an expanded account of the authors' observations on the association of bacteria with the fungus *Phyllosticta daphniphylli* in the yellow to reddish-brown lesions not only on the stems but also on the leaves of *Daphniphyllum glaucescens* [*R.A.M.*, x, p. 387]. The same organisms were further jointly responsible for the occlusion of the wood vessels and consequent desiccation of the branches. Two types of bacteria were isolated from the infected tissues, one spherical, occurring singly or in groups of two (rarely four), measuring 0·8 μ in diameter, and the other arranged in small chains (1·8 to 2·7 μ), staining with gentian violet and Gram-negative.

Boczkowska (Marie). **Les maladies et insectes nuisibles aux Graminées des tourbières à Poléssié (Pologne).** [Diseases and insects attacking Gramineae in the peat-bogs of Poléssié (Poland).]—*Rev. Path. Vég. et Ent. Agric.*, xxi, 1, pp. 39–43, 1934.

After a few brief notes on the work that is being done in Poland since 1924 with the object of reclaiming the extensive peat-bogs existing in that country for agricultural purposes, and more particularly for the establishment of pastures and hay meadows, the author gives a briefly annotated list of the diseases (nine due to fungi, three non-parasitic) and insect pests of forage grasses which have been observed at the Agricultural Research Station of Sarny. The best results in the treatment of the 'reclamation disease' [*R.A.M.*, xii, p. 656; xiii, p, 57], which is very prevalent during the first few years of cultivation of reclaimed peat-bogs, were obtained with applications to the soil of copper sulphate at the rate of 20 kg. per hect., a dose considerably lower than that found

to be effective in other countries [loc. cit.]. Thus in 1931 *Phleum pratense* developed well on plots treated with copper sulphate, while on control plots the leaves of the grass dried up prematurely, before the ears could emerge from the sheaths. *Epichloe typhina* [ibid., xiii, p. 169] was observed in 1928 and 1929 on a few plants of the *Agropyron repens* plots, while in 1930 practically all the plants on these plots were attacked by this fungus. Other records include *Erysiphe graminis*, *Puccinia graminis*, and *Claviceps purpurea*.

Diehl (W. W.). **The Myriogenospora disease of grasses.**—*Phytopath.*, xxiv, 6, pp. 677–681, 2 figs., 1934.

Details are given of the recovery of *Andropogon scoparius* clumps from Louisiana from the stunting and fasciation caused by *Myriogenospora* (?) *paspali* [*R.A.M.*, xii, p. 203], the disappearance of which coincided with the resumption of normal growth by the plants. Under the influence of the parasite the clumps presented symptoms very similar to those of pokkah-boeng of sugar-cane [*Gibberella moniliformis*: ibid., xiii, p. 59 and above, p. 686]. The fasciation which is such a striking feature of diseased plants seems to be chiefly due to a mechanical binding by the fungous tissue of adjacent leaves and culms during the growth of the shoot. Inoculation experiments with the *Myriogenospora* from *A. scoparius* on the same host, *Paspalum dilatatum*, and sugar-cane gave negative results. *M. aciculisporae*, reported on sugar-cane from Brazil [ibid., ix, p. 808], does not appear to cause the fasciation characteristic of infection by *M. paspali*, and no record exists of a *Myriogenospora* on sugar-cane in the southern United States, but otherwise there are no essential differences between these species, with which *M. bresadoleana* is also closely allied. For the present, therefore, the exact identity of the species on *Andropogon* must be left open.

Cristinzio (M.). **Malattie delle piante da frutto nella Campania e nel Mezzogiorno.** [Diseases of fruit trees in Campania and southern Italy.]—*Ricerche, osservazioni ed divulgazioni fitopatologiche per la Campania ed il Mezzogiorno* (*Portici*)—issued by R. Lab. Pat. Veg., Portici, iii, pp. 47–87, 2 pl. (1 col.), 15 figs., 1934.

An account is given of the losses caused by, and the symptoms and control of, the following diseases of fruit trees in southern Italy: leaf curl of peaches and almonds (*Exoascus* [*Taphrina*] *deformans*) and of plums (*E.* [*T.*] *pruni*), witches' broom of cherries (*E.* [*T.*] *cerasi*), peach mildew (*Sphaerotheca pannosa*), plum, cherry, and apricot mildew (*Podosphaera* [*oxyacanthae* var.] *tridactyla*, [*R.A.M.*, v, p. 699], shot hole of peach and apricot (*Clasterosporium carpophilum*) [ibid., xii, p. 301], blossom wilt of various fruit trees (*Sclerotinia cinerea*), plum rust (*Puccinia pruni-spinosae*) [ibid., xiii, p. 313], scab (*Fusicladium cerasi*) of cherries and other stone fruits [ibid., vii, p. 557], root rot due to *Rosellinia necatrix*, *Armillaria mellea*, and other organisms [ibid., xi, pp. 110, 791], and crown gall (*Bacterium tumefaciens*) [ibid., xii, p. 516].

ATANASOFF (D.). **Bitter pit of pome fruits is a virus disease. 1st Contribution.**—*Yearbook Univ. of Sofia, Fac. of Agric.*, xiii, pp. 1–8, 5 figs., 1934.

After a brief reference to his previous communication on bitter pit of apples [*R.A.M.*, xiii, p. 169], the author states that an extensive survey of orchards and nurseries during the summer of 1933 showed that the disease is widespread on apples, pears, and quinces in Bulgaria. It was further shown that all trees affected with bitter pit exhibit a characteristic mottling of the leaves [a description of which is appended], in the form of light green spots, blotches, or haloes, varying in intensity with the variety affected, and usually becoming obscure or disappearing completely during the latter part of the summer. This mottling closely resembles that of plum pox [ibid., xiii, p. 170], to a degree which would suggest the identity or close relationship of the two causal agencies. The condition was finally shown to be transmissible by grafting to healthy apple trees in a small series of experiments. It differs from the apple leaf mottling described by Bradford and Joley from Michigan [ibid., xii, p. 636], but is apparently identical with that observed by Valleau on the plum and the peach in Kentucky [ibid., xii, p. 454].

All these facts are considered to support fully the author's theory that bitter pit is a virus disease of pome trees. In his view it represents a problem as complicated as was that of the degeneration diseases of potatoes some thirty years ago, the proper solution of which will require much effort and may necessitate the production of new varieties free from infection.

CURTIS (K[ATHLEEN] M.). **Fireblight. A survey of current knowledge and recent advances.**—*Cawthron Inst. (New Zealand) Mycol. Publ.* 10, 8 pp., 6 figs., 1934.

In this paper, based on recent researches into the subject made in various countries, the author briefly traces the history of the outbreaks of fireblight of pome fruits (*Bacillus amylovorus*) that have occurred in New Zealand [*R.A.M.*, xi, p. 184]. Spread to the Nelson district of the South Island [ibid., viii, p. 795; x, p. 318] occurred during or shortly before 1932–3. An account of the disease is given in popular terms, the points dealt with including the causal organism, symptoms, transit of the bacillus in the plant tissues [ibid., viii, p. 177], overwintering, spread by insects [ibid., xii, p. 701] and rain, varietal susceptibility [ibid., xi, p. 497; xii, p. 11], host range in New Zealand and America, soil infection [ibid., xi, p. 723], and prevention and control [ibid., xii, p. 766; xiii, p. 102]. A bibliography of 18 titles is appended.

THOMAS (H. E.) & ARK (P. A.). **Nectar and rain in relation to fire blight.**—*Phytopath.*, xxiv, 6, pp. 682–685, 1934.

The nectar of pear, apple, quince, and cherry blossoms on trees grown in a dry atmosphere in California was found to contain sugars in concentrations considerably in excess of those permitting growth of the fireblight organism (*Bacillus amylovorus*) [*R.A.M.*, xii, p. 766] in culture solutions. During wet weather the volume of nectar in the blossoms is increased and its sugar concentration

reduced, and it is suggested that the higher incidence of blossom infection in wet weather may be correlated with more profuse development of the pathogen in the nectar rather than with its direct dissemination in the rain drops.

WINKELMANN (A.). **Die Fusikladium- oder Schorfkrankheit.** [The *Fusicladium* or scab disease.]—*Biol. Reichsanst. für Land- und Forstw., Flugbl.* 1, Zwölfte Auflage [Twelfth edn.], 4 pp., 4 figs., 1934.

Popular notes are given on the symptoms, life-cycle, and control of apple, pear, and cherry scab (*Venturia inaequalis*, *V. pirina*, and *V. cerasi*), and on the varietal reaction of apples and pears to the disease under German conditions.

MOORE (M. H.). **A field spraying trial of combined fungicide-contact insecticide sprays in 1933. A progress report.**—*Ann. Rept. East Malling Res. Stat. 1st Jan. 1933 to 31st Dec. 1933*, pp. 156–165, 1934.

In 1933, excellent control of scab (*Venturia inaequalis*), red spider (*Oligonychus ulmi* Kock) [*Paratetranychus pilosus* C. & F.], and sawfly (*Hoplocampa testudinea*) was obtained on Cox's Orange Pippin apple trees at East Malling [cf. *R.A.M.*, xii, p. 766] by spraying with lime-sulphur-nicotine-sulphite-lye; when derris was used instead of nicotine equally good scab control resulted, but the combination was less effective against sawfly. Owing largely to the warm, dry spring, one pre-blossom application of lime-sulphur was as effective against scab as were two, though the unsprayed controls became severely infected.

MOORE (M. H.). **Some field observations on Apple canker (Nectria galligena).**—*Ann. Rept. East Malling Res. Stat. 1st Jan. 1933 to 31st Dec. 1933*, pp. 166–175, 4 figs., 1934.

Observations [which are tabulated and discussed] on a large number of Cox's Orange Pippin and Stirling Castle apple trees at East Malling systematically sprayed for several years in succession against scab [*Venturia inaequalis*] and mildew [*Podosphaera leucotricha*] showed no consistent evidence that any particular spray applied to trees on the same rootstock gave any cumulative control of canker (*Nectria galligena*), the condition of the tree (dependent largely on soil conditions and type of rootstock) being a much more potent factor than spray treatment in determining the amount of canker infection that developed. If rootstock effect is disregarded, there was a slight suggestion that spraying, especially with Bordeaux mixture, reduced infection on the Cox's Orange Pippin trees [*R.A.M.*, ix, p. 113], which, under the conditions prevailing at East Malling, were more susceptible than the Stirling Castle trees.

Both varieties were more susceptible when worked on rootstocks East Malling XVI and XIII [ibid., xii, pp. 33, 298] than on any other.

When removing cankers all infected tissue must be cut out, but merely discoloured wood may safely be left.

Burrell (A. B.). **The effect of irrigation on the occurrence of a form of the cork disease and on the size of Apple fruits.**—*Proc. Amer. Soc. Hort. Sci.*, xxx, pp. 415–420, 1 fig., 1 graph, 1933. [Received August, 1934.]

The author states that a special form of apple cork spot [a brief description of which is given: cf. *R.A.M.*, xii, p. 769] was prevalent in 1933 in several of the United States and in the Ontario and Quebec provinces of Canada, in regions where the summer had been drier than usual, the losses in different orchards varying from nil to 75 per cent. of the crop. The principal injury was reported as occurring on the lighter soils, and to be most prevalent on trees of high vigour, e.g., those that had received liberal applications of nitrogenous manure. The disease affected chiefly, if not entirely, fruit that attained normal size. The evidence obtained from experiments in two separate orchards [details of which are given] clearly indicated that irrigation decreased the amount of this form of cork and increased the size of the fruit, to an extent which was considered by the growers concerned as satisfactory from the standpoint of commercial control. Failure to get even better control may have been due to improper timing and distribution of water, or to some other etiological factor or factors.

Tindale (G. B.). **Pears in cold storage.**—*Fruit World of Australasia*, xxxv, 6, p. 293, 1934.

When pears are kept in cold storage at a constant temperature the rate of production of carbon dioxide gradually increases to a peak and then rapidly falls to zero when scald [*R.A.M.*, ix, pp. 534, 660, 726; xi, p. 54] develops. The time required to reach this peak at any given temperature is the maximum storage life at that temperature, after which ripening is impossible, as the fruit develops mealiness, core-collapse [ibid., ix, p. 254], and other disorders. At 32° and 36° F. the Williams pear has a storage life of 12 and 7 weeks, respectively, though Winter Cole and Winter Nelis can safely be kept in cold storage for six months. Pears destined for cold storage must be picked in the hard, green state, as soon as they are large enough to pack. In general, the earlier pears mature the shorter their storage life. Each variety appears to have its own storage life irrespective of where grown.

Tiller (L. W.). **Use of copper sulphate-treated paper in the cold storage of Pears.**—*New Zealand Journ. of Sci. & Techn.*, xv, 6, pp. 403–407, 2 figs., 1934.

In a preliminary test at Nelson, New Zealand, in 1932, 75 per cent. of the sound Winter Cole pears wrapped in copper sulphate-treated paper and placed between two layers of fruit infected with *Botrytis* [*cinerea*] remained free from contamination in cold storage [*R.A.M.*, xiii, p. 246] while all the fruit in a control case containing pears wrapped in plain paper became affected. In 1933 a further experiment was conducted, using heavier paper which was found on analysis to contain 5·1 per cent. anhydrous copper sulphate. In this instance the top and bottom layers of fruit were arranged so as to be infected to varying extents by *Botrytis*

(slightly, 25 to 50, and 75 to 100 per cent.). The pears were picked on 6th March, stored unwrapped at 30° to 32° F. until 3rd July when the test was started. On examination on 2nd November it was found that only three out of 64 pears in the central layers of all three cases were infected, as against practically every one in the control boxes packed with fruit in ordinary paper. The immediate general use of fungicidally treated paper is limited in the first place by certain difficulties of manufacture which should, however, be possible to overcome, and in the second by the high cost of the material, 12 cents per lb. f.o.b. having been quoted for a New York product.

WORMALD (H.). **Bacterial diseases of stone-fruit trees in Britain. V. Some field observations and experiments on Plum bacterial canker.**—*Ann. Rept. East Malling Res. Stat. 1st Jan. 1933 to 31st Dec. 1933*, pp. 147–153, 1934.

Investigations [which are described and the results of which are tabulated] into the control of bacterial canker of plum trees in England (*Pseudomonas mors-prunorum*) [*R.A.M.*, xii, p. 227] showed that pruning or cutting back in autumn should be avoided, as on branches and stems the organism is mostly, if not exclusively, a wound parasite and infection occurs most readily in autumn and winter, probably as a sequel to leaf infection. Inoculation experiments and field observations demonstrated that Victoria plums are very susceptible to bacterial canker when worked on Brussels, Brompton, Common Plum, or Myrobolan B stocks. The Deniston Gage variety, although apparently resistant to natural infection, was as susceptible as the Victoria variety in artificial inoculations. Cankers artificially induced on Brussels stems were smaller than those similarly produced on Victoria stems. Victoria trees worked on Common Plum or Myrobolan B were less liable to be killed by the disease when worked high (so that most of the stem consisted of the rootstock variety) than when worked low (stem Victoria from ground level upwards). In a preliminary manurial trial potash applied to budded trees during the year the buds grew out had no restraining influence on their predisposition to the disease.

BROWN (H. P.). **Internal breakdown of Apricots.**—*Agric. Gaz. New South Wales*, xlv, 6, pp. 337–340, 4 figs., 1934.

Apricot fruits in the Murrumbidgee area of New South Wales are affected every year by an internal breakdown, which in 1933–4 caused very severe losses. The condition develops while the fruit is ripening, and when slight chiefly affects the larger, more heavily coloured, more mature fruits, which when cut open show a brownish discoloration near the pit; this spreads into the flesh which develops a soft, mushy rot. In severe attacks all the mature or nearly mature fruits may show the internal discoloration or rotting. Affected fruits, if they remain on the tree, exude a black, viscous fluid which produces scald-like injuries on the leaves; later they become dark brown or black, mummified, and with a pliable, leathery texture. Even slightly affected fruits dried by the usual processes are worthless.

Field and laboratory observations indicated that the breakdown is due primarily to excessive soil moisture just before picking, as the result of defective irrigation practices, climatic factors, and lack of under drainage. Fertilizers do not seem to be concerned and there is no evidence of the presence of a parasite.

Olliver (Mamie) & Rendle (T.). **A new problem in fruit preservation. Studies on Byssochlamys fulva and its effect on the tissues of processed fruit.**—*Journ. Soc. Chem. Ind.*, liii, 22, pp. 166T–172T, 1934.

Until recently the occurrence of *Byssochlamys fulva* on processed fruits [*R.A.M.*, xiii, p. 388] was believed to be strictly localized, but further investigations have shown it to be widespread on fruits grown and packed throughout England, where it constitutes an important problem of fruit preservation.

The fungus is readily cultivable on potato extract agar with inorganic salts and 10 per cent. sugar, a whitish to tawny-brown, powdery, spreading growth being produced in 48 to 72 hours at 28° to 37° C. (optimum 30° to 37°). The capacity of the fungus for sugar inversion is shown by the increase of invert sugar on Czapek-Dox solution with 9 per cent. sucrose from 1·45 per cent. after 7 days to 7·46 after 14. The maximum concentration of sucrose tolerated by *B. fulva* was found to lie between 60 and 65 per cent. Experiments with citrus and apple pectin showed that pectin is broken down by the fungus, the process of disintegration being accelerated by the addition of inorganic salts, especially in the presence of 1 per cent. peptone.

Observations have been made on the rate and manner of disintegration of various fruits packed in water and syrup, processed under commercial conditions, and inoculated with *B. fulva*. Yellow and Purple Pershore plums are readily attacked, especially if packed in water alone, and usually show extensive disintegration in two to three weeks; syrup exercises a retardatory effect on this process. Victoria plums resist the action of *B. fulva* longer than the Pershores, while damsons and greengages, though softening rapidly, retain their shape for a considerable period. Processed gooseberries become soft and broken, but the only obvious sign of fungal infection is the presence of an occasional mycelial fragment on the fruit near the surface of the container. Other fruits liable to rapid decomposition by *B. fulva* are peaches, pears, cherries, apricots, apples, and strawberries. No appreciable gas production appears to accompany the development of *B. fulva*, the acidity due to which is also very slight and imperceptible to some palates. Wounding was found to be a necessary condition for the infection of ripening fresh fruit.

The presence of *B. fulva* has been detected in at least 16 different fields or orchards on farms at a fair distance apart, and its prevalence on strawberries, which are readily contaminated by soil, suggests the latter as a probable habitat. This supposition was recently substantiated in one case where the fungus was isolated from the soil round diseased, stunted strawberry plants the fruit of which had been infected in the previous summer. Black currants, loganberries, and blackberries have been found

infected by *B. fulva* at the Campden Research Station. The fungus appears to be unknown in America and in European countries outside England.

The effects of environmental factors on *B. fulva* were studied with a view to its possible control. The growth of the fungus was inhibited even after several months by cold storage at 10° to 20° F., but the organism was not destroyed. The ascospores were found to withstand a temperature of 86° to 88° C. for 30 mins. in plum, strawberry, gooseberry, and raspberry syrups, while even young cultures (under ten days) survived 57° for the same length of time. A desiccated culture kept for a year at 37° was found to be still viable and resisted 30 minutes' heating at 82° in plum syrup, and steaming for 2 to 3½ minutes at 100° was necessary to kill the mature asci. The fungus was shown to tolerate up to 50 parts of sulphur dioxide per million in saline and plum syrup, while growth was only temporarily inhibited by ten days' exposure to ammonia (2·5 mol. of 0·88 sp. gr. per l.) and acetaldehyde (1 in 200) at freezing point, room temperature, and 37° [cf. ibid., xii, p. 46; xiii, p. 112]. *B. fulva*, although not completely anaerobic, is capable of growth under greatly reduced oxygen tension. It develops at a P_H range of 2 to 7, with an optimum about 3; the addition of citric, tartaric, and malic acids to Czapek-Dox and potato extract-sucrose cultures at concentrations up to 1 per cent. slightly accelerated growth, while those between 1 and 6 per cent. somewhat delayed it. *B. fulva* proved highly resistant to alcohol, old cultures remaining viable after 30 weeks' immersion in a 100 per cent. solution. Control measures in the factory must be based on the comparatively easy destruction of the fungus in its early stages (before the formation of the highly resistant ascospores), and in this connexion rapid handling is of the utmost importance. Intensive work is essential, however, on field control, especially in view of the facts that the fungus is certainly more widespread than was hitherto believed and probably on the increase under natural conditions.

Berkeley (G. H.). **Strawberry root rot.**—*Ann. Rept. East Malling Res. Stat. 1st Jan. 1933 to 31st Dec. 1933*, pp. 154–155, 1 pl., 1934.

After pointing out that field observations show strawberry root rot [*R.A.M.*, xiii, p. 454] to be present in many plantations in Great Britain, the author states that inoculation tests with an infusion of macerated diseased roots or with soil from an affected plot resulted in the production of definite lesions on the roots. Isolations from lesions on affected roots gave numerous fungi, the commonest being *Coniothyrium* [ibid., xiii, p. 173], *Hainesia*, *Ramularia*, and species of *Fusarium*; inoculations with pure cultures of the first and third of these gave strongly and weakly positive results, respectively.

Plakidas (A. G.). **The mode of infection of Diplocarpon earliana and Mycosphaerella fragariae.**—*Phytopath.*, xxiv, 6, pp. 620–634, 4 figs., 1934.

This is an expanded and tabulated account of the writer's studies on the mode of infection of strawberries by *Diplocarpon earliana*

and *Mycosphaerella fragariae*, a summary of which has already appeared [*R.A.M.*, xi, p. 463]. *D. earliana* penetrates the lower surface of the leaves between the epidermal cells and passes directly to the mesophyll without forming any subcuticular layer. Entry through the stomata or across the epidermal cells was never observed. In subsequent growth the mycelium remains intercellular, but haustoria are rarely if ever formed except in the peduncles, where they are abundant. Haustoria or intracellular hyphae were not observed in *M. fragariae*. There was no correlation between susceptibility to infection and the number of stomata.

MARTYN (E. B.). **A note on Plantain and Banana diseases in British Guiana with especial reference to wilt.**—*Agric. Journ. Brit. Guiana*, v, 2, pp. 120–123, 1934.

After an extensive tour of the banana-growing areas of British Guiana representatives of the United Fruit Company expressed the opinion that the symptoms of the wilt of bananas and plantains present in the colony [*R.A.M.*, viii, p. 390; x, p. 362] are identical in the majority of cases with those of the Trinidad 'moko' disease due to *Bacterium solanacearum* [see above, p. 684]. The greyish-white ooze characteristic of *Bact. solanacearum*, which appeared on cutting an affected fruit stalk, gave on isolation a bacterium with the typical reactions of this organism. Apparently, however, wilting may be caused or at least aggravated by various factors, diseased suckers containing secondary organisms which mask the real parasite. The symptoms which have been observed on Cayenne (Gros Michel), Giant Fig (Lacatan), Lady's Finger, and Dwarf bananas, and on Maiden (White) and Horse (Giant) plantains vary somewhat, but the outer leaves are generally brown and shrivelled and hang down beside the pseudostem, while the crown of younger leaves remains green. Similar symptoms are also found in plants suffering from poor cultivation in heavy soil, particularly after a dry period. The intermediate stage of yellowed leaves found in Panama disease (*F.* [*oxysporum*] *cubense*) is generally absent. If the wilted plants fruit the fingers are stunted, under-developed, and tend to turn black; the crown wilts and collapses, and the whole plant dies. The suckers show a reddish-brown to yellow discoloration of the vascular bundles, which in fruiting plants passes into the fingers. As *F.* [*oxysporum*] *cubense* has only occasionally been isolated from diseased plants the local strains of this fungus are probably less widespread and virulent than those found elsewhere.

Specifications and methods of analysis for certain insecticides and fungicides.—*Min. of Agric. and Fish. Bull.* 82, 10 pp., 1934.

As a result of discussions between representatives of the National Farmers' Union, the insecticide and fungicide manufacturers, and the Ministry of Agriculture, the Association of British Insecticide Manufacturers undertook to bring up to date the specifications for insecticides and fungicides published in the Ministry s Advisory Leaflet No. 9 and to add new ones. These last have been accepted

by the Government Chemist, the National Farmers' Union, and the Ministry; members of the Association of British Insecticide Manufacturers and certain other firms have agreed to conform to these standards, and purchasers of the materials in question are strongly advised to require a guarantee that they comply with the specifications. Agreed methods of analysis which have been drawn up in connexion with these specifications are described.

The new specifications [which are given] include, amongst others, those for lime-sulphur solution, copper sulphate, Bordeaux and Burgundy powder, Cheshunt compound [*R.A.M.*, i, p. 373], and formaldehyde.

[A shorter version of this paper appears in *Journ. Min. Agric.*, xli, pp. 225–228, 1934.]

DULAC (J.). **Utilisation des propriétés du sulfure de cuivre.** [The utilization of the properties of copper sulphide.]—*Comptes rendus Acad. d'Agric. de France*, xx, 19, pp. 650–652, 1934.

Copper sulphide, being practically insoluble in water, adheres well to herbaceous plant organs; it oxidizes rapidly on contact with air to produce copper sulphate, the intensity of this process increasing *pari passu* with the rising humidity and temperature which favour vine mildew [*Plasmopara viticola*]; and its oxidation products, being pure copper salts, possess the maximum degree of toxicity towards the fungus [*R.A.M.*, xiii, p. 423], a property that is not shared by ordinary disinfectant mixtures. Copper sulphide and its oxidation products have not been found to scorch the foliage of treated vines. The results of experiments at the Montpellier Agricultural College have demonstrated the utility of these compounds in the treatment both of vine mildew and shot hole of peach [*Clasterosporium carpophilum*].

A. (G.). **L'emploi de l'argile colloïdale dans la préparation des produits anticryptogamiques.** [The use of colloidal clay in the preparation of fungicidal products.]—*Rev. Prod. Chim. et Act. Scient.*, xxxvii, 9, pp. 260–264, 1934.

This is a slightly abbreviated translation of A. S. McDaniel's recent paper entitled 'Colloidal bentonite-sulfur. A new fungicide', a notice of which from the original source has already appeared [*R.A.M.*, xiii, p. 528; cf. also next abstracts].

FYFE (H. E.). **Bentonite and its occurrence in New Zealand.**—*New Zealand Journ. of Sci. & Techn.*, xv, 6, pp. 386–394, 3 figs., 1934.

An account, based on a study of the relevant literature supplemented by an analysis of samples from Waitangi Hill, 25 miles north-west of Gisborne, New Zealand, is given of the nature, origin, and commercial uses (actual and suggested) of bentonite, defined by Ross and Shannon (*Journ. Amer. Ceram. Soc.*, ix, p. 77, 1926) as 'a rock containing 75 per cent. or more of the crystalline clay-like materials, montmorillonite or biedellite' [see preceding and next abstracts].

Bentonite: properties, sources, geology, production, uses.—*Silica Products Co., Kansas City, Missouri, Bull.* 107 (Revised edn.), 40 pp., 19 figs., 4 graphs, 2 maps, 1934.

Bentonite [see preceding abstracts], here defined as 'a natural hydrous silicate of alumina having the distinctive property of forming a homogeneous and highly viscous solution, gel or sol, in the presence of not less than ten times its weight of water', with the chemical formula $Al_2O_3 \cdot 4SiO_2 \cdot xH_2O$, is discussed under the following aspects: physical properties, identification, geographical occurrence, geologic origin, methods and extent of production (20,000 tons from Wyoming in 1933), and special uses, e.g., as a fungicidal adjunct.

Ein neuer Dämpfer für Erddesinfektion. [A new steamer for soil disinfection.]—*Blumen- und Pflanzenbau verein. mit Gartenwelt*, xxxviii, 22, p. 281, 1 fig., 1934.

A simple and economical steamer for soil sterilization, known as 'Akra', has recently been put on the market by the Kyffhäuser foundry, Artern. It holds some 2 cwt. of soil and excessive evaporation is obviated by a detachable lid.

Isfort (A.). **Praktische Einrichtung für das Dämpfen von Erde und Töpfen.** [A practical contrivance for the steaming of soil and pots.]—*Blumen- und Pflanzenbau verein. mit Gartenwelt*, xxxviii, 22, p. 281, 1 fig., 1934.

A note is given on the excellent performance of the 'Alfa' steamer for soil sterilization [*R.A.M.*, xii, p. 460], the manipulation of which may be still further simplified by the installation of a crane and pulley, easily workable by a 15-year-old boy.

Actes et documents officiels. [Acts and official documents.]—*Agron. Colon.*, xxiii, 197, p. 152, 1934.

French Cameroon. A local decree of 17th February, 1934, regulates the organization of the newly established phytopathological laboratory at Douala and defines its functions in respect of the study of plant diseases and control measures. The services to be performed by the director of the laboratory include the supervision of the phytosanitary and quarantine systems and the compilation of a list of diseases of cultivated plants in the Cameroons.

Records of agricultural projects known to have failed through plant diseases.—*Plant Disease Reporter*, xviii, 2, pp. 1–16, 1934. [Mimeographed.]

At the instance of the Plant Disease Survey a number of experienced plant pathologists have supplied notes on the partial or total failure of entire crop projects in various parts of the United States through the agency of diseases for which no adequate control measures are known or where the cost of treatment renders the crop uneconomic. Numerous striking cases in which the disease factor has rendered the cultivation of the crop unduly hazardous in particular districts are mentioned.

Renouf (L. P. W.). **Zostera disease on the coast of County Cork, I.F.S.**—*Nature*, cxxxiii, 3372, p. 912, 1934.

In the summer of 1932 the extensive *Zostera* meadows in Castle Haven, County Cork, Irish Free State, were observed to be less luxuriant than usual, and a year later they had disappeared [*R.A.M.*, xiii, p. 646]. A similar decline was noticed in Lough Ine in December, 1933, followed some two months later by disappearance. During the spring of 1934 an extensive resumption of growth was seen to be taking place over a large part of the affected areas. Interesting features of the disease in southern Ireland are the slowness of its progress, requiring a period of two years to travel six miles, and the rapidity of recovery, at any rate in the later affected districts. At Castle Haven there is stated to be no renewal of growth, with the result that the numbers of flatfish are diminishing. *Z. marina*, *Z. nana*, and a hybrid are all affected by the wasting disease in County Cork.

Mounce (Irene) & Diehl (W. W.). **A new Ophiobolus on Eelgrass.**—*Canadian Journ. of Res.*, xi, 2, pp. 242–246, 9 figs., 1934.

No adequate explanation being available for the almost complete disappearance of eelgrass (*Zostera marina*) from the western Atlantic coast of North America, as well as in parts of Europe [see preceding abstract], it is considered advisable to record the detection at St. Andrews, New Brunswick, in September, 1933, of a hitherto unknown fungus on this host. The organism, which is named *Ophiobolus halimus* Diehl and Mounce n.sp., described in English and Latin, illustrated, and compared with related species, was collected on rhizomes and fertile shoots and developed on leaves kept in sea water in the laboratory.

O. halimus is characterized by sparse, intramatrical, sphaeroid, blackish-brown perithecia, 240 to 435 μ in diameter, with one or more rostrate ostioles, the beaks being conoid, acute, blackish, and up to 278 μ long by 260 μ in basal diameter; and arcuate-fusoid, subsessile, aparaphysate asci, 270 to 300 by 12 to 15 μ, containing eight filiform, acicular-arcuate to spring-like spiral ascospores, 260 to 308 by 2 to 4 μ, terminating at the attenuated tip in a hyaline appendix up to 3 by 1·3 μ.

Nicolas (G.) & Aggéry (Mlle B.). **Notes mycologiques et phytopathologiques.** [Mycological and phytopathological notes.]—*Bull. Soc. Hist. Nat. Toulouse*, lxv, 3, pp. 506–507, 1933. [Received May, 1934.]

Garlic in the market-gardens of Toulouse is stated to be attacked in a destructive form by *Sclerotinia libertiana* [*S. sclerotiorum*] which covers the bulbs with a white mould bearing numerous minute, black sclerotia; by the end of May the plant bases are withered and the bulbs are beginning to decay. The fungus is a very dangerous parasite owing to its longevity in the soil and its polyphagous character [*R.A.M.*, v, p. 269] and the transference of the garlic cultures to fresh ground may well become imperative.

Zaghouania phillyreae completes its entire life-cycle on *Phillyrea media*, forming uredospores all the year round on the leaves and branches, which become hypertrophied and shrivel, teleutospores

from February to April, and aecidia with aecidiospores and a few spermogonia in May to June. *P. latifolia* bears only a few aecidia and *P. angustifolia* some aecidia and uredospores under Toulouse conditions, although they were reported by Dumée and R. Maire in 1901 to be equally affected with *P. media* in Corsica.

Dufrénoy (J.) & Dufrénoy (M. L.). **Cytology of plant tissues affected by viroses.**—*Phytopath.*, xxiv, 6, pp. 599–619, 17 figs., 1934.

A summary and discussion are given of the results of experiments and observations by the first-named writer and others on the cytological modifications undergone by plant tissues affected by virus diseases. Many of the papers referred to have been noticed in this *Review*.

Curzi (M.). **Proprietà e natura dei virus delle piante.** [The properties and nature of plant viruses.]—*Riv. di Biol.*, xvi, 2, pp. 335–352, 1934.

After reviewing the essential characters of the plant viruses as described in the relevant literature [much of which has been noticed from time to time in this *Review*], the author discusses from a critical standpoint the three theories that have been advanced in explanation of their nature, namely, autocatalytic, microbial, and ultra-microbial [*R.A.M.*, xiii, pp. 588–589]. In his opinion, some of the virus diseases attributed to ultra-microscopic organisms are actually due to the filterable forms of microbes—a phase assumed by the latter to facilitate the penetration and infection of living cells and to assist in overcoming the defences of the host tissues.

Asai (T.). **Über das Vorkommen und die Bedeutung der Wurzelpilze in den Landpflanzen.** [On the occurrence and significance of the root fungi in land plants.]—*Japanese Journ. of Botany*, vii, 1–2, pp. 107–150, 13 figs., 1934.

The writer's extensive investigations in Japan showed that mycorrhizal formation is a very common feature of land plants, very few of which seem to be exceptions to what is evidently a general phenomenon. A list is given of some 17 Pteridophytes and Gymnosperms in which the writer found mycorrhiza, nearly always endotrophic. These include the sporophyte of several ferns and the ordinary roots of *Cycas revoluta*. Of the very large number of monocotyledons and dicotyledons examined, a high proportion had mycorrhiza, the endotrophic being the more common in the latter and the only type observed in the former group. In general the higher classes in systematic position were the most regularly infected with endophytes. *Casuarina equisetifolia* had the fungal endophyte in its ordinary thin roots in addition to its well-known bacterial nodules [*R.A.M.*, xii, p. 583]. Weeds belonging to the Polygonales and Centrospermae were never found to bear mycorrhiza, nor were any found on the Cyperaceae, Araceae, Commelinaceae, Juncaceae, Urticaceae, Nymphaceae, and Cruciferae examined. Altogether endotrophic mycorrhiza were found in about 82 per cent. of the very large number of families examined.

Extensive notes are given on the distribution of mycorrhiza in different plant formations. Amongst the cultivated Gramineae endotrophic mycorrhiza were found in sorghum, oats, barley, wheat, maize, *Panicum crus-galli* var. *frumentaceum*, *P. miliaceum*, and *Setaria italica*.

The endophytes may be divided into two structural types, namely, one widely distributed in the roots of a large number of land plants, concentrated mainly in cell layers next the endoderm, avoiding the epidermis, and with main hyphae 5 to 7 μ in breadth, while the other, practically restricted to the Diapensiales and Ericales, is found mainly in epidermal cells and has hyphae only 2 to 3 μ in diameter. This last type is more nearly related to the ectotrophic form. The special type of endophyte found in the Orchidaceae is believed to have developed from the second type as seen in *Pyrola japonica*. Growth in water is adverse to mycorrhizal production and even species that form mycorrhiza on land (e.g., rice) fail to do so when growing in water. Except for this, no other environmental factor inhibiting mycorrhiza formation was observed. Mycorrhizal infection takes place four to five weeks after the germination of the seed, penetration being effected through the epidermis of the slender roots. The fungus may survive for more than a year by means of a residue of hyphae escaping ingestion by the higher symbiont. The mycorrhizal fungus is virtually confined to the root hair zone of the slender roots, through which it is supplied with a portion of the nutrients assimilated by the host and further enabled to utilize materials from the soil not directly available to the higher symbiont. As the roots continue their development the fungus is dissolved and undergoes ingestion by the host [cf. ibid., xiii, p. 590].

MATTIROLO (O.). **Rapporti simbiotici sviluppatisi tra il Tartufo 'Bianchetto' (Tuber borchii Vittadini) ed i Pioppi americani detti canadesi.** [Symbiotic relations developed between the small, white truffle (*Tuber borchii* Vittadini) and the American (so-called Canadian) Poplar.—*Ann. R. Accad. Agric. Torino*, lxxvi, pp. 3–10, 1934.

Tuber borchii, a small, white truffle with a considerable market value in Italy during the spring and summer [cf. *R.A.M.*, xii, p. 486], has been found in close association with poplar (*Populus canadensis*) roots in two localities of Piedmont. Although the host has been acclimatized in Italy for about a hundred years, the occurrence of truffles on its roots appears to be quite a new development.

CAPPELLETTI (C.). **Il problema immunitario nei vegetali in rapporto con l'agricoltura.** [The problem of plant immunity in relation to agriculture.]—*Ann. R. Accad. Agric. Torino*, lxxvi, pp. 91–111, 1934.

An outline is given in general terms of the problems connected with immunity in agricultural plants from parasitic fungi (with reference also to symbiosis in the Orchidaceae). Most of the investigations discussed have been noticed from time to time in this *Review*.

Corneli (E.). **Temperature di germinazione di spore fungine in relazione alle infezioni sugli ospiti.** [Temperatures of germination of fungal spores in relation to infection of the hosts.] —*Nuovo Giorn. Bot. Ital.*, N.S., xli, 1, pp. 121–133, 1934.

As a result of comparative experiments [some details of which are given] the author found that while the spores of *Fusarium herbarum*, isolated from rotting carnation stems [*R.A.M.*, xiii, p. 515], germinated at temperatures ranging from 8° to 34° C., with an optimum at 25° to 26°, indications of parasitism of the fungus on living, artificially infected carnation stems could only be obtained at about 20° to 26°, the aggressiveness of the fungus increasing (from nil at 12° to 14°) as the temperature approached the optimum point for germination of the spores, and rapidly decreasing at 31° to 32° and above. Similarly with *Erysiphe graminis*, the spores of which germinated between 5° to 6° and 26° to 27°, with an optimum at 18° to 20°, the maximum attack of the fungus on barley seedlings in controlled tests was obtained at temperatures close to the optimum for germination, infection failing to establish itself at temperatures round about the two extreme points of the range. These results are considered to indicate that temperature is the chief factor determining the capacity of these fungi for overcoming the natural resistance of the hosts to their establishment in the tissues.

Trotter (A.). **La degenerazione della Patata e le malattie da virus.** [Potato degeneration and virus diseases.]—*Ricerche, osservazioni ed divulgazioni fitopatologiche per la Campania ed il Mezzagiorno (Portici)*—issued by R. Lab. Pat. Veg., Portici, iii, pp. 18–48, 3 pl. (1 col.), 2 figs., 1934.

In this lucid and succinct review of the information at present available on potato virus diseases the author, after briefly noting the more salient field symptoms of the various types of potato mosaic [*R.A.M.*, xii, p. 648] and leaf roll [ibid., vi, p. 633; xi, p. 668], witches' broom [ibid., xii, p. 48], pseudo-net necrosis [ibid., x, p. 746; xii, p. 319], and concentric necrosis (considered to be the same as internal brown or rust spot and spraing) [ibid., xiii, p. 649], describes and discusses the classifications of potato virus diseases based by Quanjer [ibid., xi, p. 394] and Schander and Bielert [ibid., vii, p. 460] on necrotic tissue changes, and by Elze [ibid., x, p. 813] on transmissibility by insects. In the section dealing with prevention and control he summarizes different methods devised by various workers to ascertain the degree of degeneration present in the tubers [ibid., x, p. 543; xi, p. 395; xii, p. 239; xiii, p. 649]. A bibliography of 49 titles is appended.

Opitz (K.), Tamm (E.), Goepp (K.), Rathsack (K.), & Soltau (F.). **Beiträge zur Kartoffelbau, insbesondere zum Abbauproblem.** [Contributions to Potato cultivation, especially in connexion with the degeneration problem.]—*Landw. Jahrb.*, lxxix, 5, pp. 737–781, 1 fig., 9 graphs, 1934.

A comprehensive, fully tabulated account is given of the writers' five years' experiments at the Berlin-Dahlem Agricultural Institute

on various aspects of potato cultivation, with special emphasis on the problem of degeneration.

Different varieties were found to respond in a totally divergent manner to the highly unfavourable environmental conditions of the locality. Modrows Blaupunkt, for instance, merely gave an expression of extreme nutritional deficiency without definite pathological symptoms, whereas in other cases leaf roll, mosaic, dwarfing, or a combination of these and other manifestations were visible.

It was found that the tendency to degeneration contracted under the adverse conditions at Dahlem could be readily counteracted by transference, even for one season, to the relatively favourable environment of Bornim (Potsdam), with a somewhat less sunny, cooler, and more humid climate.

No support was forthcoming for Klapp's theory that degeneration is a consequence of excessive demands on the productivity of the plant [*R.A.M.*, xiii, p. 178]. On the contrary, some of the highest yielding varieties in these tests, e.g., Ackersegen, Cellini, and Sickingen, maintained their tendency to give high yields even when grown in the area subject to degeneration.

NIELSEN (O.). **Kartoffelsorter og Kartoffelsygdomme. Fortsatte orienterende Undersøgelser.** [Potato varieties and Potato diseases. Preliminary investigations continued.]—*Tidsskr. for Planteavl*, xl, 1, pp. 105–118, 3 figs., 1934.

In continuation of previous investigations at Lyngby, Denmark, on the reaction to leaf roll and mosaic in a number of standard potato varieties [*R.A.M.*, xii, p. 715], five were placed in the resistant group for leaf roll (0 to 10 per cent. infection), viz., Imperia, Ackersegen, Field Marshal, Beveländer, and Industrie; only Ackersegen and Beveländer are also resistant to mosaic. Susceptibility to leaf roll (10 to 85 per cent. infection) was shown by Alpha, Erdgold, King Edward, Karma, Di Vernon, British Queen, Procentragis, Early Eclipse, and Sharpe's Express, while heavy infection (85 to 100 per cent.) was recorded on Duke of York, Gelkaragis, Birgitta, Preussen, and Golden Wonder (the yield of which was reduced by 82 per cent.). The ten varieties Di Vernon, Duke of York, Early Eclipse, Sharpe's Express, Ackersegen, Beveländer, Birgitta, British Queen, Golden Wonder, and King Edward are resistant to mosaic, while Alpha, Erdgold, Field Marshal, Gelkaragis, Imperia, Industrie, Karma, Preussen, and Procentragis are susceptible.

Based on tuber examinations, Beveländer, Erdgold, and Karma showed a high degree of resistance to late blight (*Phytophthora infestans*), with a maximum of 1 per cent. infection; fair resistance (1 to 3 per cent.) was shown by Ackersegen, Procentragis, Birgitta, Alpha, Preussen, Gelkaragis, and Golden Wonder; while over 10 per cent. infection, denoting great susceptibility, was recorded on Industrie and Di Vernon. Beveländer and Ackersegen are thus relatively resistant to the two virus diseases and blight.

The incidence of infection by *Rhizoctonia* [*Corticium*] *solani* was found to range from 27·1 and 27·7 per cent., respectively, on the two very late varieties Alpha and Ackersegen to 75·1 per cent. on the early King Edward. These figures, however, appear to be

correlated rather with the stage of maturity reached at the period of sclerotial development (round about 10th September) than with any inherent differences in varietal reaction to the fungus.

Scab (*Actinomyces* spp.) [including *A. scabies*] occurs only in a comparatively mild form in the Lyngby district, but as far as can be judged under local conditions the most resistant of the test varieties is King Edward (average of 1·4 per cent. in four years) and the most susceptible Industrie (4·1).

Wart disease (*Synchytrium endobioticum*) continues to spread notwithstanding all efforts to check it [ibid., ix, p. 671; x, p. 816; xi, p. 768]. Varietal tests in respect of this disease have not been carried out in Denmark, where reliance is placed on English and German wart-immunes. Of these Ackersegen and Erdgold are outstanding by reason of their productivity and resistance to late blight and scab.

Barton-Wright (E. C.), Cockerham (G.), & M'Bain (A. M.). **Virus disease research.**—ex *Rept. Director of Res. Scottish Soc. Res. in Plant Breeding Ann. Gen. Meeting 26th July, 1934*, pp. 15–17, 1934.

Four of the potato varieties used in field tests at the Corstorphine Station and Ainville Sub-Station of the Society for resistance to leaf roll [see preceding abstract] showed a marked capacity to withstand the disease, namely, Shamrock, Cardinal, Chance, and Kepplestone Kidney. Of these the first-named had already manifested a superior degree of resistance in grafting experiments, and a number of crosses have been made between it and certain susceptible types, while natural selfs have also been obtained.

At Huntly Sub-Station [Aberdeenshire] the study of hereditary and virus-induced degeneracy in potato progenies has been continued, with particular reference to the development of 'seedling leaf roll' in progenies arising from parents carrying individual viruses and virus complexes. The number of plants of the 'seedling leaf roll' type appearing in such progenies was shown to be correlated with the severity of virus infection in the parents, irrespective of the virus concerned. Metabolic disturbances in the virus-diseased parents are believed to cause degeneracy of this sort in individual members of the progeny.

Black (L. M.). **The Potato yellow dwarf disease.**—*Amer. Potato Journ.*, xi, 6, pp. 148–152, 1934.

The writer was informed by E. S. Schultz in correspondence that in 1930 the latter obtained transmission of yellow dwarf of potatoes [*R.A.M.*, xii, p. 187] by grafting diseased Green Mountains on healthy Bliss Triumphs in 11 out of 25 cases. In the winter of 1931–2 the writer was also successful in transmitting the disease by grafting in 57 out of 61 plants, the incubation period in the greenhouse at 27° C. ranging from 22 to 61 days with an average of 38. In subsequent tests under different conditions a minimum incubation period of 17 days was recorded. In New York State the earliest symptoms of yellow dwarf are usually observed about the last week in July. The clover leaf hopper, *Agallia sanguinolenta*, was found to act as a vector of yellow dwarf. Overwintering

adults on grass land were shown to be viruliferous, so that the infective principle must either reside in the insects themselves or in some plant other than potato.

Hill (Helen D.). **A comparative study of certain tissues of giant-hill and healthy Potato plants.**—*Phytopath.*, xxiv, 6, pp. 577–598, 1 fig., 8 graphs, 1934.

Measurements of stem lengths and leaf counts of giant-hill potato material [*R.A.M.*, xii, p. 48; xiii, p. 534] in Pennsylvania confirmed field observations on the relative constriction of diseased as compared with healthy tops. The leaves of affected plants were thinner than those of healthy ones, the percentage reduction being 4·92 and 13 in 1930 and 1932, respectively. The palisade mesophyll cells of giant-hill potato leaves were considerably narrowed and somewhat shorter than those of healthy plants. In the petioles of diseased plants the inner phloem was slightly more abundant than in those of healthy ones, and somewhat more extensive in relation to the xylem, while the outer phloem was rather scanty in the affected tissues. On the other hand, the stems of giant-hill plants contained considerably less inner phloem than healthy ones, the percentage reduction being 23·35 in 1930 though less marked in 1932. In the affected stems the inner phloem was also less abundant in relation to the xylem than in healthy ones. No differences could be detected in the individual cell elements of xylem or phloem between diseased and healthy plants. These results may be interpreted as indicating a disorganization of the photosynthetic and conducting tissues in giant-hill plants of a comparable order to those characteristic of certain other virus diseases of the potato, though relatively mild in expression.

Cristinzio (M.). **La 'necrosi del cuore' dei tuberi di Patata.** [Heart necrosis of Potato tubers.]—*Ricerche, osservazioni ed divulgazioni fitopatologiche per la Campania ed il Mezzogiorno* (*Portici*)—issued by R. Lab. Pat. Veg., Portici, iii, pp. 3–17, 2 pl., 3 figs., 1934.

From 1930 onwards, up to 70 per cent. of individual consignments of apparently healthy Böhms seed potatoes imported into Italy showed, when cut, sparse, light rusty spots (often surrounded by a transparent halo) in the centre of the flesh, converging into darker spots which in turn merged into a reddish-brown to dark brown, occasionally zonate, area up to 2 cm. long by about 1 cm. wide; this frequently broke down to form a cavity in which the dead tissues formed dark, compact masses adhering to, or detached from, the walls. The condition, which was very occasionally observed on other varieties from Germany, Holland, England, Poland, and Esthonia, closely corresponded macroscopically and microscopically with heart necrosis [*R.A.M.*, xii, p. 784] and internal hereditary spotting [ibid., xii, p. 319]. It was distinct from black and hollow heart [ibid., xi, pp. 357, 535].

Histological examination showed that as the affected cells became necrosed a suberized layer formed around the whole or a part of the necrosed area, cork formation ceasing when the necrosis became arrested. The formation of the cavity was mainly due to the

suberized zone interrupting the nutritional exchange between the healthy and affected tissues, the latter becoming detached and dying.

When affected and healthy imported Böhms tubers were planted the yield from the former though apparently equal in quantity and quality with that of the latter showed 10 to 75 (average 33) per cent. affected tubers. In a further test with imported Böhms seed tubers and others grown in Italy from imported seed of the same variety the former gave 27 and the latter 43 per cent. affected potatoes, indicating that the proportion of the progeny to become affected increases with each planting. In both tests the necrosis sometimes began while the tubers were very young, becoming fully evident only at maturity. As cavities were seldom noted, they probably develop in storage and are not necessarily symptomatic.

The author attributes the disease to the action of a virus and considers it to be a localized form of hereditary internal spotting probably associated with the particular susceptibility of the Böhms variety. It should be placed in category V (pseudo-net necrosis) of Quanjer's classification [ibid., x, p. 746].

A bibliography of 17 titles is appended.

Němec (A.). **Über die Zusammensetzung der Mineralstoffe einiger krebsfester und gegen Krebs anfälliger Kartoffelsorten. (Vorläufige Mitteilung.)** [On the composition of the mineral substances of some wart-resistant and wart-susceptible Potato varieties. (Preliminary note.)]—*Die Phosphorsäure*, iv, 6, pp. 352–357, 1934.

A tabulated account is given of the writer's preliminary studies at the Biochemical Institute of the Prague Agricultural Experiment Stations on the mineral composition of the tubers of four potato varieties resistant to wart [*Synchytrium endobioticum*], namely, Modrows Preussen, Viktoria, Hindenburg, and Kěrkover Kidney as compared with the same number of susceptible ones (Erstling [Duke of York], Böhms Erfolg, Kěrkover Industrie, and Deutschbroder Kidney).

Little difference could be detected in the ash content of the two groups, except for a general tendency to deficiency in potash in the tubers of the susceptible varieties. The latter, however, showed much greater fluctuations in the lime content (1·48 to 3·15 per cent. calcium oxide) than the resistant group (2·12 to 2·48 per cent.). The resistant varieties were found to be much higher in magnesium oxide (6·22 to 9·87 per cent.) than the susceptible group (4·51 to 5·5 per cent.), while manganese was also more plentiful in the former than in the latter, with the exception of Böhms Erfolg. The ratio of magnesium to calcium oxide ranged from 2·93 to 4·44 : 1 in the resistant group, compared with 1·55 to 3·24 : 1 in the susceptible. Industrie and Hassia (susceptible) potatoes receiving 3 doppelzentner superphosphate or basic slag per hect. in addition to 1·5 doppelzentner ammonium sulphate showed an increase in the magnesium and manganese contents over those given only ammonium sulphate. In another test at the Valečov (Czecho-Moravian uplands) Experiment Station the magnesium content of the resistant tubers was found in most cases to range from twice

to four times as high as the lime. A number of varieties showed much the same mineral composition in various localities and under divergent cultural conditions.

Potato tubers actually infected by wart disease contained an abnormally high proportion of lime in relation to magnesium (ratio of magnesium to calcium oxide 0·31 : 1·37) the corresponding figures for the excrescences themselves being 0·18 : 0·32, while silicic acid also preponderated considerably both in the diseased tubers and in the warts [cf. *R.A.M.*, xii, p. 718].

CROSIER (W.). **Studies in the biology of Phytophthora infestans (Mont.) de Bary.**—*Cornell Agric. Exper. Stat. Memoir* 155, 40 pp., 11 graphs, 1934.

Continuing his studies on *Phytophthora infestans* [*R.A.M.*, xiii, p. 120], the author gives a detailed account of experiments (many of which were made in closely controlled temperature and humidity chambers) directed to investigate as many as possible of the factors involved in the host-pathogen-environment complex in the etiology of the potato blight problem [cf. ibid., xiii, p. 468]. The results [which are tabulated and shown as graphs] indicated that in pure culture on oatmeal-dextrose agar the temperature range for growth of *P. infestans* is from 3° to nearly 30° C. with an optimum at 21°, which is also the optimum for the rapidity and abundance of production of sporangia in a saturated atmosphere. On potato tuber slices [ibid., xiii, p. 120], however, the average size of the sporangia produced gradually decreased as the incubation temperature increased from 3° to 26°. At temperatures above 20° the sporangia lost their viability in from one to three hours in dry air, and in from 5 to 15 hours in moist air. The optimum temperature for indirect germination (by zoospores) of the sporangia was 12°, and that for direct germination (by germ-tubes) 24°. The duration of motility of the swarm spores ranged from 15 minutes at 24° to 24 hours at 1° to 2°; their germination occurred at all temperatures between 3° and 28°, at least 70 per cent. germinating at temperatures between 6° and 24°. Germ-tube elongation was most rapid at 21° and 24°.

In controlled experiments on potato plants more infections resulted from inoculation on the lower than on the upper leaf surface. At temperatures between 10° and 25° the mycelium resulting from the germination of the zoospores established itself in the host tissues in 2½ hours, and its spread in the tissues was most rapid at 20° to 23°. From 90 to 100 per cent. infection occurred when conditions favourable for penetration continued for a period of ten hours. The period of incubation (appearance of visible lesions) was shortest, from 66 to 82 hours, at 20° to 23°; it was 78 hours at 30° and 120 hours at 10°. In potato stems in particular *P. infestans* tolerated intermittent high temperatures up to 40°.

In some cases the severity of infection was determined by the age of the plants, young individuals being usually more severely blighted than older plants [cf. ibid., xiii, p. 468]. The apical leaves of the Yellow Globe tomato were shown to be immune from late blight, although the lower ones were very susceptible. The

beyond the callosity. Hyphae are produced by the sac and not only rapidly occupy the entire cell cavity but penetrate adjacent cells through the rupture of the walls. No evidence was observed of hyphal penetration through the stomata.

SHARPLES (A.). **Annual Report. Pathological Division.**—*Ann. Rept. Rubber Res. Inst. Malaya, 1933*, pp. 105–120, 1934.

The sole constituents of the normal root disease complex of *Hevea* rubber in Malaya are the diseases caused by *Fomes lignosus*, *Ganoderma pseudoferreum*, and *F. noxius*, all of which spread by means of a rhizomorph system [*R.A.M.*, xiii, p. 124]. These diseases are a direct legacy from the original jungle, and the fungi concerned follow a threefold life-cycle. The first stage consists in the attack by the rhizomorphs, the second in the penetration of the newly invaded root sections and the spread of the mycelium towards the centre, and the third in the production of rhizomorphs again at an advanced stage of decay of the root. Penetration of the host is independent of mechanical wounds and results from hyphae produced at the surface of contact of rhizomorph and host which penetrate readily through the healthy bark.

These root parasites have become generally distributed throughout the jungle, but while the jungle trees are growing the loss of stand never becomes serious. After felling and burning, however, the parasites are at first threatened with destruction as the rhizomorphs are unable to use dead plants as hosts, with the result that the life-cycle is broken at the end of the rhizomorph-producing phase. Except under special conditions the rhizomorphs cannot grow directly through the soil, but require a chain of solid surfaces (such as is provided by roots), and though they can spread on dead root surfaces they appear to be unable to enter and obtain nourishment from roots already colonized by other organisms.

Root disease in rubber plantations develops in two distinct stages. The first lasts for the four or five years after planting, while the roots expand to fill their respective planting sites. If a site contains rotted, infected jungle roots the rubber inevitably becomes infected and dies during this stage, which manifests itself by the gradual infection and death of patches of trees in the young stand, the limits of the patches coinciding with those of the original patches of jungle infection. The second stage begins as soon as the root systems of adjacent trees become firmly interlaced, when infection can begin to spread beyond the patches of jungle infection; this phase gives rise to the expanding patches of disease typical of mature stands.

In June, 1933, panel disease or white fan blight [ibid., iii, p. 680; ix, p. 405] occurred on two rubber estates. The whole of the affected surfaces were covered with fine, silky strands of mycelium and in advanced cases had a silvery-white appearance. The mycelial plates and strands resembled those of a *Marasmius*, and fructifications developed in the laboratory confirmed this determination; the fungus, which under certain conditions is actively parasitic, rotting the bark and cortical tissues of the newly tapped surface down to the wood, is regarded as being almost certainly *M. palmivorus* [ibid., xii, pp. 355, 507].

In the section [by F. Beeley] dealing with the rubber mildew situation in Malaya it is stated that in 1933 attack by *Oidium heveae* was unique in its suddenness and short duration. In inland areas in the States of Selangor and Perak where heavy rain fell throughout the first five months of the year, rubber estates were practically free from the disease, but in the Port Dickson (Negri Sembilan), Malacca, and Sitiawan (Perak) districts only light showers fell from February to April, and these induced an almost epidemic spread in March, when most of the trees were just growing new leaf [ibid., xiii, p. 470]. Some 3,000 acres of mature trees were dusted with sulphur, and it is estimated that in 1934 the area to be dusted will exceed 20,000 acres, almost all in the Malacca and Negri Sembilan districts.

VERONA (O.). **Studio microbiologico di un terreno torboso.** [A microbiological study of a peat soil.]—*Arch. für Mikrobiol.*, v, 3, pp. 328–337, 1934. [German summary.]

Fungi were found to be the principal micro-organisms present in a Po Valley (northern Italy) peat soil, those present including *Aspergillus glaucus*, *A. flavus*, *Penicillium crustaceum*, *P. luteum*, *Fusarium roseum*, and species of *Verticillium*, *Sclerotium*, *Trichoderma*, and *Mucor* [cf. *R.A.M.*, xii, p. 191]. The ammonia-forming and nitrogen-fixing properties of the soil were insignificant and nitrification practically absent. Denitrification, however, took place on an extensive scale and carbonic acid production was abundant.

HOERNER (G. R.). **Crown gall of Hops.**—*Phytopath.*, xxiv, 6, pp. 688–691, 1 fig., 1934.

Of 400 sexless Late Clusters hop plants rogued in Oregon in 1932 6·25 per cent. were found to show crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) infection [*R.A.M.*, x, pp. 750, 766]. Three distinct types of the disease are differentiated: (1) involving the entire crown and comparatively rare; (2) affecting the underground stem buds and causing 'hairy root'; and (3) the most prevalent form, in which the organism attacks isolated portions of the underground plant parts or a section of the crown at or near ground level. The crown gall organism was isolated from both the second and third types on Early and Late Clusters and inoculated into Fuggles and Late Clusters with positive results. From the third type an isolation was made under Dr. Riker's supervision which caused similar galls on inoculation into tomatoes.

PARK (M.). **Bacterial leaf-spot of Betel.**—*Trop. Agriculturist*, lxxxii, 6, pp. 393–394, 1 col. pl., 1934.

A brief, popular account is given of the symptoms, manner of spread, and control of the leaf spot of betel [*Piper betle*] caused in Ceylon by *Bacterium betle* [*R.A.M.*, vii, p. 741].

'Approved' varieties of Sugar Cane.—*Australian Sugar Journ.*, xxvi, 3, p. 139, 1934.

The Director of the Bureau of Sugar Experiment Stations announces certain changes in the list of sugar-cane varieties, the

cultivation of which is permissible in the areas served by various central sugar mills in Queensland. In many cases official approval is dictated by the resistance of the varieties to diseases prevalent in particular areas. Thus, the approved varieties for the Eagleby Mill area are Q. 813, N.G. 36, H.Q. 285, Korpi, and Oramboo, while owing to the heavy infestation of this area by Fiji disease [*R.A.M.*, xiii, p. 324], the cultivation there of the highly susceptible P.O.J. canes is inadmissible. All the above-mentioned varieties are resistant to Fiji disease and early maturing.

Brandes (E. W.), Taggart (W. G.), & Chadwick (R. H.). **New Canes for Louisiana.**—*Sugar Bull.*, xii, 19, pp. 1–2, 1934. [Abs. in *Facts about Sugar*, xxix, 8, p. 282, 1934.]

Two new canes, C[anal] P[oint] 28/11 and C.P. 28/19, have been released for planting in Louisiana. Both are susceptible to mosaic and sheath rot [*Cytospora sacchari*: *R.A.M.*, xii, p. 114], but the former is very resistant to red rot [*Colletotrichum falcatum*: ibid., xiii, pp. 182, 595]. The new varieties are recommended as valuable substitutes for P.O.J. 234, combining as they do good ratooning qualities (deficient in the latter) with earliness. C.P. 28/19 is superior to C.P. 28/11 as regards constitution and yielding capacity.

Arthur (J. C.). **Manual of the rusts in United States and Canada.**—xv + 438 pp., 487 figs., 1 map, Purdue Research Foundation, Lafayette, Indiana, 1934.

In this manual, which is most conveniently arranged and easy to use, the writer has compressed a mass of information into a small space. One of the objects of the work is to assist the general botanist in the determination of rust (Uredinales) collections, while the other is to present a classification showing the phylogenetic relationship of species and genera as consistent with the present state of knowledge as lineal arrangement permits [cf. *R.A.M.*, ix, p. 344]. Species showing clear indications of descent from a common ancestor are grouped under the most completely developed member of the group, the reduced forms following under the same member though still keeping their rank as specific units. The geographical area covered comprises Greenland, Newfoundland, Canada, and the continental United States, including Alaska and the Aleutian Islands. In addition to the comprehensive annotated account of the species forming the basis of the work, lists are given of the abbreviations used for the names of authors of rusts and hosts, supplemented by explanatory notes on terms and usage, a glossary, and indices of rusts and hosts. Nomenclatural priority is taken to date from 1753, not 1801 as in Art. 19 *c* of the International Rules of Nomenclature.

Arthur (J. C.). **Terminologie des Urédinales.** [Terminology of the Uredinales.]—*Bull. Soc. Myc. de France*, l, 1, pp. 130–133, 1934.

This is a complete translation into French of the author's original paper on the terminology of the Uredinales, an abstract of which has already been published [*R.A.M.*, xi, p. 746].

Morquer (R.). **Considérations biologiques sur les variations du Botrytis cinerea et spécialement sur une nouvelle forme pathogène pour les Culicides.** [Biological considerations on variations in *Botrytis cinerea* and especially on a new form pathogenic to the Culicidae.]—*Bull. Soc. Hist. Nat. Toulouse*, lxv, 4, pp. 603–617, 1933. [Received May, 1934.]

The writer points out that the heterogeneity of the genus *Botrytis* arises from an artificial grouping of conidial types of very distantly related Ascomycetes, including Discomycetes such as *Mniaecia jungermanniae* and Hypocreaceae represented by *Cordyceps*. The division of the genus into several subgenera may be provisionally retained. The delimitation of *Eubotrytis* and *Cristularia* seems to be legitimate, whereas *Polyactis* [cf. *R.A.M.*, ix, p. 691], based on insufficiently known conidiophores, should be dropped and its representatives incorporated with *Phymatotrichum*.

B. cinerea is a collective species, embracing on the one hand morphological species of the second rank, differing among themselves in morphological details and especially in their mean dimensions, and on the other biological species characterized by varying capacities of parasitism, host specificity, and virulence. A full description is given of *B. cinerea* forma *theobaldiae* [ibid., xiii, p. 233], found parasitizing the larvae of Culicidae, to which it was shown by inoculation experiments to be pathogenic. It is characterized on Hayduck's medium by ashen-grey, orange-tinted conidiophores of very variable length, 10·5 to 15·5 μ in basal diameter, producing branches 4·5 to 6·5 μ thick terminating in ampullae averaging 10·5 μ (8 to 13 μ) in diameter, covered with mucronate sterigmata bearing ovoid to ellipsoid, occasionally piriform, hyaline conidia, 11 to 14 by 6·5 to 8 μ (mean 13·4 by 7·8 μ), the dimensions of these organs on Sabouraud's agar being considerably larger (11·7 to 18 by 7·8 to 11 μ). The terminal ampulla (of which this is stated to be the first mention) is considered to be a valuable diagnostic character.

Lehman (S. G.). **Contaminated soil and cultural practices as related to occurrence and spread of Tobacco mosaic.**—*North Carolina Agric. Exper. Stat. Tech. Bull.* 46, 43 pp., 5 figs., 1 diag., 1934.

Carefully planned tests are stated to have shown that mosaic is the cause of much heavier losses among the tobacco crops of North Carolina than is generally realized by local growers. When the disease gains a foothold early in the season the depreciation in the yield and quality of the stand may account for a reduction of 50 to 60 per cent. or more as compared with the market value of healthy plants.

It was found that the proportion of plants contracting infection directly from infested soil was four to five times as high where the diseased plants overwintered on the land and were disked into the soil as where the stalks and roots were removed or were cut up by disking in the autumn. Ploughing diseased material under deeply in the autumn gave poorer control of initial mosaic infection, and ploughing it under in the spring rather better control,

than cutting it up with a disk in the spring. The deeply covered plants, protected from freezing by the soil cover, appear to retain sufficient vitality to produce diseased suckers whence the virus may be transferred to new plants. Autumn disking, on the other hand, uproots and mutilates the plants in such a way that they undergo considerable decay during the winter and so constitute less of a risk to the new crop. Similar treatment in the spring is less effective, since an abundance of active virus may persist in the roots of plants allowed to stand over the winter.

The spread of mosaic in young plants by chewing or smoking tobacco while handling, e.g., in weeding or transplanting, was confirmed [*R.A.M.*, xiii, p. 189] as was also spread by carelessness in topping, the incidence of infection being increased from 10·5 to 40·7 per cent. in one test and from 10·2 to 62·4 per cent. in another by indiscriminate topping of diseased and healthy plants. Mosaic is also spread extensively in the field after the plants have grown large enough to rub the implements used in cultivation. In two tests on artificially inoculated plots the amounts of infection were increased from 5·3 to 64 per cent. by two cultivations and from 5·4 to 80·8 per cent. by four, respectively, the spread occurring laterally as well as along the rows. With an initial mosaic infection of only 1 per cent., the careless grower may find 60 to 90 per cent. or more of his plants diseased by the beginning of harvest. The spread of mosaic on infested plots was effectively checked by roguing, which necessitated the removal of an average of only 1·5 per cent. of the plants on the 23 experimental plots. Tobacco should not be re-set in the places vacated by the rogued plants, contamination being probable in a large proportion of such cases.

Ternovsky (M. F.). **Die Fragen der Immunität bei Vertretern der Gattung Nicotiana.** [Questions of immunity among representatives of the genus *Nicotiana*.]—*Der Züchter*, vi, 6, pp. 140–144, 1934.

One of the most serious tobacco diseases in the Crimea (U.S.S.R.) is mildew (*Erysiphe cichoracearum* f. *nicotianae*) [*R.A.M.*, vii, pp. 273, 278], to which 18 representatives of *Nicotiana tabacum* and 4 of *N. rustica* (*texana*, *trigonophylla*, *jamaicensis*, and White Burley) proved susceptible in artificial inoculation experiments under controlled conditions at the Nikitsky Botanic Garden in 1932–3. Of the 18 wild and ornamental species used in the tests, only *N. glauca* and *N. sylvestris* contracted an insignificant degree of infection. The F_1 species hybrids *N. tabacum* × *N. sylvestris* and *N. tabacum* × *N. glauca* were less severely attacked than the *N. tabacum* parent, while *N. glutinosa* × *N. tabacum*, *N. tabacum* × *N. sanderae*, and *N. rustica* × *N. tabacum* remained immune from the disease. The nature and extent of the latter on *N. rustica* and *N. sylvestris* were so sharply contrasted with the symptoms on *N. tabacum* as to suggest corresponding morphological differences in the fungus, and the conidia were in fact shown by measurements to fall into two groups [details of which are not given] according to the hosts.

The importance of hybridization experiments in connexion with

the development of mildew-immune tobacco varieties is briefly discussed.

KARRAKER (P. E.) & BORTNER (C. E.). **Studies of frenching of Tobacco.**—*Kentucky Agric. Exper. Stat. Res. Bull.* 349, pp. 63–109, 7 figs., 1934.

This is a detailed and tabulated account of field and greenhouse experiments carried out for several years at the Kentucky Agricultural Experiment Station in the attempt to determine the relationships of frenching in tobacco (chiefly Burley) to soil reaction and to the supply of available plant nutrients [cf. *R.A.M.*, xiii, p. 191]. The condition was not observed to develop in soils of moderate or strong acidity (below P_H 5·8), irrespective of the supply of nutrients. At higher P_H values it developed when the amount of available nitrogen, phosphorus, and potassium, either singly or in combination with each other, was low, and sufficient additions of these elements brought about the recovery of frenched plants. It was not usually more common or more severe in heavily limed than in slightly acid soils; indeed there was some evidence that in the former there was less frenching than in neutral or slightly acid soils. It thus appeared, from nutritional-physiological considerations, that the effect of reaction on frenching was one of calcium supply, and it is suggested that the effect of calcium was mainly within the plant, possibly by affecting the translocation of protein compounds and other nutrients to the growing points.

The relation of the supply of nutrients to frenching was not so direct and consistent as the relation of this supply to growth. In the greenhouse, deficiency in nitrogen appears to play a more important part than lack of phosphorus or potassium, although the condition frequently developed in soil or sand with a high nitrate content but deficient in phosphorus or potassium. It was necessary to maintain a high level of all three elements in available form during plant growth to prevent frenching in the presence of favourable reaction for the disorder. In the field, no definite conclusions could be arrived at in regard to the relation of the supply of nutrients to frenching, but the balance of evidence indicated that a higher level of nutrients is required to prevent the trouble than is necessary to give satisfactory plant growth. In the work done no relationship could be established between frenching and the presence or absence of other mineral elements.

It is suggested that while these studies rather clearly show the condition to be related to soil reaction and nutrient supply, there may yet exist some other factors which may affect the reaction and nutrient factors, or be affected by them.

TROTTER (A.). **I disturbi funzionale e le alterazione fogliari del Tabacco.** [The functional disturbances and foliar modifications of Tobacco.]—*Boll. Tecn. R. Ist. Sperim. Coltiv. Tabacchi 'Leonardo Angeloni'*, Scafati (Salerno), xxxi, 1, pp. 13–51, 5 pl., 7 figs., 1934. [English summary.]

The writer discusses, in the light of the relevant literature and contemporary research, various types of non-parasitic disorders of tobacco leaves occurring in Italy and elsewhere, including top rot

eight oval to elliptical, uniseptate ascospores averaging 7·3 to 16·1 by 4·1 to 7·5 μ (mean 11·9 by 5·7 μ). The microconidia are typically unicellular, occasionally septate, and the macroconidia elongated, slightly curved, 3- to 9- (mostly 5- to 6-) septate, and 60 to 90 by 5 to 6 μ (range 48 to 125 by 4·2 to 6·6 μ). The fungus made practically no growth at 33° C.; at 27° the initial rate of development was more rapid than at laboratory temperature, but the advantage was not maintained. Ascospore discharge was found to take place at temperatures decreasing almost to freezing-point, while the macroconidia germinate at temperatures down to 3°. The maximum growth was made at P_H 8·0, with a range of 4·5 to 9·6. Spore-trap experiments showed that ascospore discharge follows rains of sufficient duration to wet the bark and continues until after the surface of the bark and perithecia appears dry; both ascospores and macroconidia are air-borne.

The evidence for the joint participation of *C. fagi* and the *Nectria* in the causation of the beech bark disease rests on (1) the constant association of both organisms with the disorder, (2) the absence of the latter when only one is present, (3) the consistent isolation of the fungus from infected tissues, and (4) the incapacity of the latter to attack any tissues other than those infested by the insect. It was experimentally shown that, in general, the fungus can only invade bark already infested by the insect for upwards of a year.

On ornamental trees the beech bark disease may be combated by the timely use of insecticides. In the forest the first step is the salvage of infected, dying, and recently killed timber, but some measure of control may be possible by natural enemies of *C. fagi* and by improved silvicultural measures.

A five-page bibliography is appended.

LEDEBOER (MARIA S. J.). **Physiologische onderzoekingen over Ceratostomella ulmi (Schwarz) Buisman.** [Physiological investigations on *Ceratostomella ulmi* (Schwarz) Buisman.]—Thesis, Univ. of Utrecht, 95 pp., 8 graphs, Hollandia-Drukkerij, Baarn, 1934. [German summary.]

These physiological studies [which are fully described and tabulated] on *Ceratostomella ulmi*, the agent of the well-known die-back of elms in Holland and elsewhere, were carried out in synthetic media with ten strains of the fungus, eight isolated by the writer from Dutch material and two supplied by Dr. C. Buisman, while an eleventh, isolated by M. Boudru at Gembloux, Belgium [*R.A.M.*, xiii, p. 335], was included in the experiments on the effects of mineral salts on the organism.

Fairly good growth was made at 8·5 C., the optimum for development being 25° and the maximum about 34°. Coremial production was favoured particularly by the ultra-violet rays of the sun (15 minutes' exposure) [cf. ibid., xii, p. 316 *et passim*]. The minimum, optimum, and maximum hydrogen-ion concentrations for the growth of *C. ulmi* were generally found to be $P_H \pm 8$, 6 to 7, and ± 5, respectively, though in the presence of peptone development was possible at P_H 3·6. The following sources of carbon were utilized: 5 per cent. saccharose (the best), glucose, maltose, lactose, galactose,

glycerine, mannite, and starch; cellulose was not attacked. Nitrogen was supplied by ammonia compounds, asparagin, and peptone. Potassium phosphate (0·1 per cent.) and potassium sulphate (0·001 to 0·01 per cent.) exerted a marked stimulatory action on the growth of *C. ulmi*, while 0·1 per cent. sodium chloride proved injurious. Magnesium was found to be an indispensable element, the minimum concentration inducing growth being 0·0015 and the optimum 0·15 per cent. Calcium exercised a favourable effect, especially in the presence of magnesium concentrations between the minimum and optimum. Zinc sulphate (0·002 to 0·02 per cent.) promoted a compact mycelial texture in contrast to the usual loose, transparent growth; at 0·1 per cent. a distinct retardation was generally observed. In minute quantities copper stimulated development, a similar effect resulting from the addition to the medium of manganese carbonate or sulphate. At low concentrations (not exceeding 0·001 to 0·01 per cent.) mercuric chloride also activated the growth of *C. ulmi*.

None of the elements used in these investigations can be considered from the standpoint of practical control, since the concentrations at which they harm the fungus are too high to be safely applied to the host.

The Dutch Elm disease.—*Science*, N.S., lxxix, 2058, pp. 516–517, 1934.

The number of elms in the United States found to be affected by die-back [*Ceratostomella ulmi*] is stated to have risen within a year from 10 to 1,480; in this connexion a brief, popular note on the symptoms and mode of dissemination of the fungus is given, with an appeal for public co-operation in the prompt detection and diagnosis of infection [*R.A.M.*, xiii, p. 664].

Welch (D. S.), Herrick (G. W.), & Curtis (R. W.). **The Dutch Elm disease.**—*Cornell Coll. of Agric. Extens. Bull.* 290, 19 pp., 8 figs., 1934.

An account is given in semi-popular terms of the so-called Dutch elm disease (*Ceratostomella ulmi*) of the American elm (*Ulmus americana*), described as the most valuable shade and ornamental tree in the United States, besides being of considerable silvicultural importance. At the time of writing (June, 1934), one infected tree had been found in each of the States of Connecticut, Maryland, and Ohio, in addition to 1,200 previously reported from New Jersey and New York and eight eradicated in Ohio in 1930–1 [see preceding abstract]. The fact that a large proportion of the trees now known to be diseased contracted infection in 1933 illustrates the rapid spread of the fungus during the brief period since its establishment in the area having as its centre the port of New York. The success of the present eradication campaign is stated to be by no means assured, mainly owing to the prevalence of the insect carriers (*Scolytus multistriatus* and possibly other bark beetles) in the infected and adjacent areas; at the time of the Ohio outbreak these agents of dissemination were not known to be present. A list is given of possible substitutes for the elm,

which cannot, however, be readily replaced for the reasons indicated above.

RAO (M. G. V.) & IYENGAR (K. G.). **Studies in spike disease of Sandal. I. Two types of spike disease. II. The movement of the virus in Sandal plants.**—*Indian Forester*, lx, 7, pp. 481–491, 4 pl., 1934.

Two types of sandal (*Santalum album*) spike are differentiated on the basis of the authors' field observations in southern India [*R.A.M.*, xiii, p. 198], namely the common or rosette type and the so-called pendulous form which is prevalent in certain areas of the Tumkur, Hassan, and Mysore districts of Mysore State. The rosette symptom complex is characterized by short, stiff branchlets, clusters of shoots due to the development of dormant buds, minute, narrow, stiff leaves, entire absence of flowering in the affected shoots, and rapid death of root ends and haustoria. In the pendulous type of spike, on the other hand, the leaf-bearing twigs are long and drooping, there is no bunching of shoots and no sprouting of the dormant buds, the leaf blades are unusually large and broad (two or three times the area of those on rosetted shoots), sparse flowering occasionally takes place, and the haustoria and root ends die very slowly. The flowers, sometimes borne on apparently healthy branches of spiked trees, are already known often to show phyllody, but the authors found in addition a reduction in size of the flower buds and abnormal elongation of the pedicels to three or four times the normal length. The pistil is sometimes prolonged into a thick cylindrical body, bent on itself. No fruit is formed. These floral abnormalities are sometimes the first outward sign that the tree has become infected.

The pendulous type is as readily transmitted by grafting as the common type, 18 out of 30 tests being successful. The resulting infection was always of the pendulous type. In plants inoculated by means of twig-grafts with both the rosette and pendulous strains of spike, intermediate symptoms developed, including some excessive branching and rapid death of the root ends as in the former type, in comparison with which, however, the leaves are rather broader and the twigs longer, with a marked tendency to drooping. Such combined forms were commonly encountered naturally in localities where both types of spike are found.

It was ascertained by means of grafting experiments that the infective agent of spike is unable to traverse the xylem tissues, since a potted sandal plant inoculated with a spiked bud graft remained completely healthy above a 'ring' made on the stem by stripping off the cortex, whereas the lower part developed all the symptoms of the disease. Presumably, therefore, the passage of the virus is effected by way of the phloem and cortical parenchyma cells. Considerable variations were observed in the rate of spread of the agent of the disease in plants inoculated by budding, the budded part being subsequently isolated from that below either by ringing or by cutting it off. The most rapid movement was over 12 in. in 89 days after inoculation and the slowest under 11 in. in 172 days.

DOVER (C.) & APPANNA (M.). **Entomological investigations on the spike disease of Sandal (20). Studies on insect transmission.**—*Indian Forest Records* (Entom. Ser.), xx, 1, pp. 1–25, 3 pl., 1934.

The indirect evidence for the implication of an insect in the transmission of spike disease of sandal (*Santalum album*) [see preceding and next abstracts] is stated to be based on the results of experiments by members of the Indian Institute of Science and the Madras Forest Department, in which plants protected from the presumed vectors of infection by cloth cages remained healthy, while others exposed to the entry of insects contracted the disease. In a series of tests with aphids (a species of *Macrosiphum*) from *Lantana* [*camara*], the presence of which is consistently associated with a high incidence of spike [cf. ibid., xii, p. 129], symptoms bearing a close resemblance to the disease in question were induced in one plant.

The most important result of the present series of experiments [which are tabulated] is considered to be the transmission by *Moonia albimaculata*, a Jassid of common occurrence on *Lantana* and *Erythroxylon monogynum*, of a disorder indistinguishable from spike in five out of over 300 sandal plants exposed for 77, 169, 117, 112, and 59 days, respectively, to contact with the insects. The symptoms developed within two to three months. By 1st September, 1933 (8 to 15 months after the initiation of the tests on the different plants), two were dead and three spiked notwithstanding the provision of suitable hosts for the root haustoria of the sandal, and manuring, which would have promoted recovery from a purely physiological disturbance. The symptoms under observation, moreover, are quite distinct from the yellowing and dwarfing due to adverse conditions affecting the sandal tree or to heavy insect attack. Of some value as evidence of a connexion between *M. albimaculata* and spike transmission is the negative outcome of several tests with a number of dominant representatives of the sandal fauna. The five diseased plants were analysed for their nitrogen and starch contents [cf. ibid., xiii, p. 594], the results of the analyses further supporting the evidence that they were spiked, while additional evidence was the detection of intracellular inclusions in a cytological examination carried out by M. J. Narasimhan [ibid., xii, p. 479] on one of the affected plants.

DOVER (C.). **Insect transmission of spike disease.**—*Indian Forester*, lx, 7, pp. 505–506, 1934.

The writer has inspected the sandal [*Santalum album*] plants used by Sreenivasaya in his tests to establish by graft transmission of the disease whether the trees to which it was claimed that *Moonia albimaculata* had conveyed the virus were really infected with spike disease [*R.A.M.*, xiii, p. 550 and preceding abstracts]. He concludes that the negative outcome of the tests is due to the failure of organic fusion of the grafts between the infected and healthy plants. He is further unable to accept the statement regarding the complete recovery of the 'infected' plants.